DECEMBER, 1940

# FACTORY

## MANAGEMENT and MAINTENANCE

A McGRAW-HILL PUBLICATION

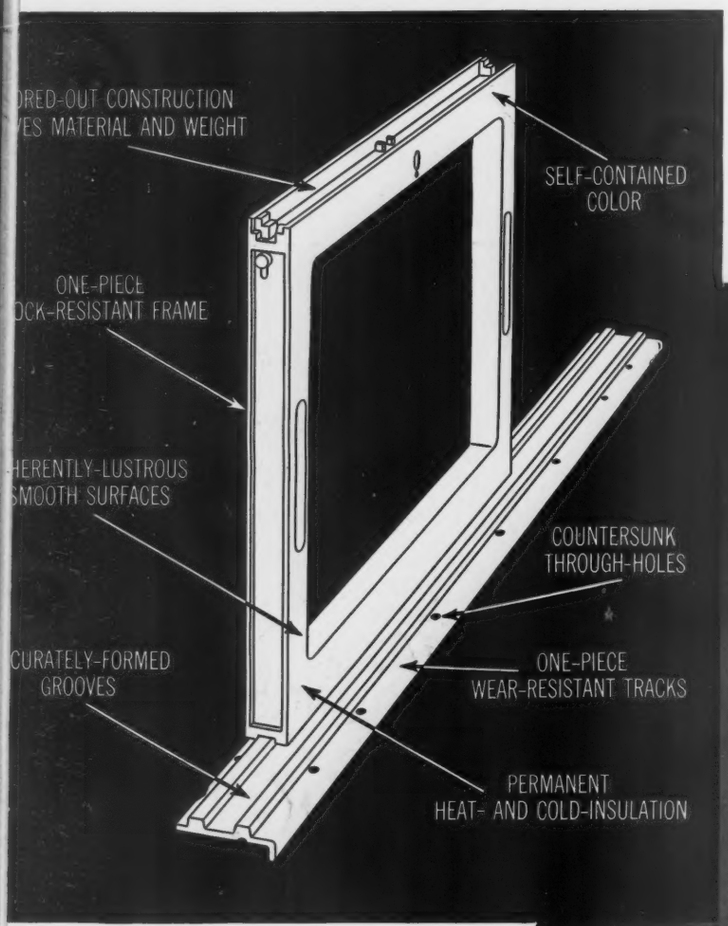
COVER STORY: SEE CONTENTS—PAGE 5

## SABOTAGE? You Haven't Seen Anything Yet

Representative J. Parnell Thomas, Member, Dies Committee (Page 42)

LIGHTER IN WEIGHT, YET STURDIER IN SERVICE

# Large Refrigerator Doors and Tracks are Economically Molded from Bakelite Plastics



MEASURING up to 55″ in length, Door Tracks for Hussman-Ligonier Company's Refrigerated Display Cases as well as Door Frames as large as 19″x 28″ are now fabricated at low cost—in a single molding operation—from Bakelite Plastics. Machining and other finishing steps are eliminated, for every mechanical detail and the permanently lustrous jet-black surfaces are provided in the molding process. In addition, a sturdier design is made possible with a 15% reduction in weight as compared with the material previously used. See how Bakelite Plastics can benefit *your* products by writing for booklet 12P, "New Paths to Profits".

BAKELITE CORPORATION
*Unit of Union Carbide and Carbon Corporation*
UCC
30 EAST 42ND STREET, NEW YORK

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TRADE MARK

The word "Bakelite" and the identifying products Symbol are registered trade-marks of Bakelite Corporation

**PLASTICS HEADQUARTERS**

# The rubber roller coaster that takes mountains for a ride

## *A typical example of Goodrich development in rubber*

TAKE a look at plants that furnish stone for roads, dams, bridges. Whole mountains of gravel are carried by rubber-and-cotton conveyor belts to crushers and screens, where rocks are crushed and sorted according to size.

Looks troubleproof, but big rocks would catch in pulleys, tear expensive belts to ribbons.

Goodrich engineers weren't going to let that go on . . . they developed an entirely new belt design. Instead of stiff woven fabric which cuts and tears like any cloth, this new Goodrich belt is made of individual cords like a tire, some lengthwise, some crosswise, each cord surrounded with rubber. Tearing action won't pass along the belt—at worst an obstruction causes a small, easily-repaired hole instead of a long, ruinous tear.

The new Goodrich belt was installed in the Wyoming plant in the picture. A test (not on the program) came the first day. A heavy crowbar caught in the belt, bent like a hairpin around the pulleys, and wedged against the framework where it would have ripped any other belt to useless shreds. But the Goodrich cords held until power could be shut off, and a $2000 belt was saved.

Goodrich improvements in all rubber and synthetic goods are making savings just as spectacular, in plants in every industry. Isn't it just good business to let your Goodrich Distributor tell you what those savings might be in your operation? *The B. F. Goodrich Company, Mechanical Goods Division, Akron, Ohio.*

**Goodrich**

ALL *products problems* IN RUBBER

# *Meet Today's Emergency*— MODERNIZE YOUR EQUIPMENT WITH

# P.I.V. GEARS and SILENT CHAIN DRIVES

P.I.V. Gear Speed Control, mounted with motor and two Silverstreak Silent Chain Drives on large lathe.
Silverstreak Silent Chain enclosed in oil-tight housing for final drive. Note variable speed control brought within operator's easy reach.
Small lathe motorized through Silverstreak Silent Chain Drive.
Vertical P.I.V. Gear used on drill press drive.
Silverstreak Silent Chain between motor and P.I.V. Gear.

● Demand for greater output without additional floor space posed a problem to an eastern manufacturer. Plant engineers found the solution in individual motor drives, through Link-Belt Silverstreak Silent Chain, and P.I.V. Gear variable speed control. Three of the many machines so modernized are illustrated. The large lathe (center illustration above) employs one silent chain from motor to P.I.V. Gear unit, and a second from P.I.V. to machine. This is typical of many cases in the plant. On the drill press, (lower left illustration) one silent chain connects the motor to the P.I.V. Gear, which is coupled direct to the machine. On tools not requiring variable speed, constant speed drives are obtained by using only silent chain. (upper right illustration).

All shafting and belts are eliminated, avoiding belt failures and slippage, improving lighting conditions, and increasing safety. Power loads are better distributed. Infinitely variable speed control gives most efficient speed for each operation, quickly set and positively maintained. Silverstreak silent chain drives give positive, dependable high speed transmission with practically no attention or upkeep expense.

All these features add up to a better product and greater output at less cost, without extensive capital investment.

Find out what P.I.V. Gear positive infinitely variable speed control, Link-Belt Silverstreak silent chain drives and other positive drives can do for you. Send for catalogs.

●

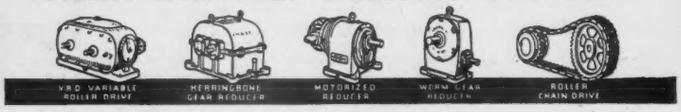
**LINK-BELT P.I.V. GEAR SPEED CONTROL**

**LINK-BELT COMPANY**

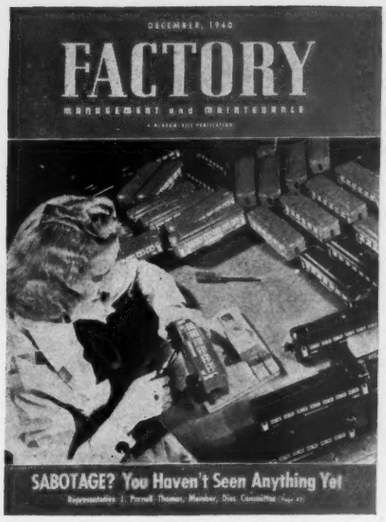
Philadelphia, Chicago, Indianapolis, Atlanta, Dallas, San Francisco, Toronto.
Offices, warehouses and distributors in all principal cities. 8333

●

**OTHER LINK-BELT POSITIVE DRIVES**




**LINK-BELT Silverstreak Silent CHAIN DRIVES**




**December being the Christmas season, FACTORY's ace color photographer went to the Lionel Corporation's plant in Irvington, N. J., where they make trains like the one you bought Junior last year. Take our word for it, Lionel uses mass production techniques. But we wanted color, and Lionel's modern production methods did not lend themselves to color photography. Hence the simple hand operation shown here.**

•

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A McGRAW-HILL PUBLICATION

# FACTORY

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DECEMBER, 1940

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**TODAY . . . with swiftly changing events calling for production at capacity levels and more efficient and economical plant operation . . .**

# TIME COUNTS

**So . . . for full speed ahead on U. S. Defense Orders, enlist the help of trained Oakite Service Men to smooth out all "traffic jams" from your CLEANING OPERATIONS!**

With production of defense items swinging into high gear in answer to the call for speed . . . CLEANING is an operation of prime importance in promoting maximum output. And it MUST be dependable . . . must contribute to a smoothly functioning production line.

When you put modern, dependable Oakite cleaning materials, methods and service to work in your plant, you will find, as have thousands of other concerns, that your production cleaning responds with new SPEED and new THOROUGHNESS. Results are more satisfactory, inspection is facilitated. Quite important, too, is the fact that unit costs are attractively low. Moreover, Oakite materials bring you greater SAFETY . . . safety to product and to plant personnel. And among the over 53 different Oakite cleaning materials available, you will find one or more especially designed to meet your PRODUCTION or MAINTENANCE cleaning requirements.

Through our nation-wide organization of Service Representatives, you obtain the FREE services of men with long, practical experience, whose recommendations are backed by a binding GUARANTEE that fully protects your interests in every way. Tell us your cleaning problems . . . let us help now! Since there is no obligation . . . won't you write us today?

**MINUTE MESSAGES**
**FROM THE FIELD ON OAKITE SAVINGS**

**ENDS FREQUENT SHUT-DOWNS:** A hot strip mill using Oakite Grinding Compound for grinding steel rolls reports that it keeps tank and pipe lines on machine clean, thus eliminating previously required shut-down of machine to clean out tank and pipe lines.

**BREAKS THREATENED BOTTLE-NECKS:** Until recently two 8-hour shifts were needed in cleaning and pickling room of this vitreous enameling plant to produce enough work to supply one 8-hour shift for firing in furnace room. With Oakite materials, cleaning is speeded-up and rejects are reduced to the point where cleaning and pickling room now produces enough work in single 8-hour shift to provide for 9 hours' activity in furnace room.

**REDUCES WARP SPINNING RING EXPENSE:** Using an Oakite material, a Southern cotton mill now reclaims a large proportion of warp spinning rings which were formerly discarded. Method is easy; cost is only a fraction of what new rings would cost.

**CUTS SALVAGE COSTS:** Salvage Dept. of one Western gas company finds that the use of an Oakite material in their cleaning tank for removing paint, oil and dirt from pipe fittings and other parts has cut their costs 20 per cent.

**DOES AN HOUR'S JOB IN 20 MINUTES:** One Midwestern food plant likes an Oakite material for cleaning kettles because it has substantially reduced the amount of scrubbing required . . . so much so that a perfect job is now done in one-third less time.

**INCREASES PRODUCTION 200%:** Switching to Oakite materials for stripping paint from gas cylinders enables manufacturer of commercial gases to strip 300 per day instead of 100. Same equipment and same number of men used.

Manufactured only by

**OAKITE PRODUCTS, INC., 14A Thames Street, NEW YORK, N. Y.**

Representatives in all Principal Cities of the U. S. and Canada.

**OAKITE** MATERIALS . METHODS . SERVICE

Certified

**CLEANING** FOR EVERY CLEANING REQUIREMENT

# This Free Bulletin will help you

# BE PREPARED!

Here's up-to-the-minute aid on a critical problem: How to protect plants and offices from prowlers and saboteurs...against emergencies and "accidents" that can cripple vital defense work.

A *plant protection check list* makes it easy for you to spot and eliminate possible danger points in advance. It points the way to extra security by 15 specific questions you can check in your own factory.

You get brief but specific information on *protective floodlighting* for plant yards, railroad sidings, storage tanks, etc., and on interior "nightlights" to help the watchman do a better job.

*Alarm systems and signaling equipment* to protect against fire and theft and to give immediate warning in case of emergency are included . . . along with suggestions for immediate and "interruption-proof" intercommunication.

You'll want to check, too, on suggestions for *protecting plant power and lighting circuits* . . . to make sure that vital operations can't be brought to a halt by accidental or deliberate interruption. » » » For your copy . . . mail coupon to GRAYBAR today!

Wires Cut
Sabotage Seen in Factory Fire
Intruder Seized in Aircraft
Blue Prints Stolen
G-Men Warn Against Unprotected Grounds
Planned Protection
CAN MEET THIS CHALLENGE!
Today, as production essential to defense is spread to an ever-widening group of plants, the danger of intruders and "unauthorized visitors" is no longer remote. Government experts are advocating greater precautions; foresighted management is insisting upon protective measures in plants serving defense needs either directly or indirectly.
To assure planned protection for your plant, GRAYBAR is prepared to give you specialized aid in analyzing your needs for electrical means to keep intruders out, to warn of emergencies, and to give instant communication throughout plant, offices and outbuildings. After you have gone over the plant protection check list below, why not put your "danger points" up to GRAYBAR for solution?
Everything Electrical
GraybaR
ELECTRIC COMPANY
PLANT PROTECTION CHECK LIST
PROTECTIVE LIGHTING
1. Are your yards, sidings, storage tanks, loading platforms and other outdoor areas well lighted throughout with suitable flexibility of switching? (Page 2)
2. Is your system of night lights in plants, warehouses, drafting rooms, offices arranged to discourage intruders and aid the watchman? (Page 2)
3. Are your indoor and outdoor lighting circuits installed so that a slight "accident" cannot leave vital areas in total darkness? (Page 4)
4. Are watchmen equipped with dependable electric lanterns for emergency use? (Page 3)
PROTECTIVE "LINES OF COMMUNICATION"
5. Is your system for recording the watchman's rounds the modern electrical type that cannot be "cheated"? (Page 3)
6. Have burglar alarm systems been installed to protect offices and other areas where intruders could force an entry? (Page 3)
7. Is your fire-alarm system modern and dependable, with conveniently located boxes and all the necessary warning accessories? (Page 3)
8. Does a paging system for keeping in touch with key men throughout offices and plant enable them to be located in an emergency? (Page 3)
9. Is intercommunication throughout the plant swift, clear and dependable, and protected against "accidental" interruption? (Pages 3 and 4)
10. Is intercommunication to extended that gatemen or receptionists can be sure that outsiders with legitimate business in one department "get to their men" and are not allowed freedom to roam the plant, either going or coming? (Page 3)
11. Does a button signal at the entrance sound bells throughout the plant when someone wishes to enter "after hours"? (Page 3)
12. Do you have a general alarm system for emergencies? (Page 3)
PROTECTION AGAINST POWER FAILURE
13. Is vital production equipment powered by well-protected circuits that can't be put out of action by a seeming "accident"? (Page 4)
14. Are electrical distribution circuits and communication circuits to outbuildings so installed that they can't be cut or broken by storm or other emergency? (Page 4)
15. Is an adequate stock of "spares" and emergency supplies on hand for rapidly restoring electric service to vital areas in case of fire, explosion or other unforeseen interruption? (Page 4)

## A SPECIALIST IS "ON CALL" TO HELP YOU

**If you have a plant protection problem involving (1) outdoor lighting (2) indoor lighting (3) signaling or intercommunication (4) sure-power wiring, why not let a GRAYBAR SPECIALIST give you the help you need? He'll recommend the products that best fit your requirements . . . products by leading manufacturers with the additional satisfaction-insurance of the GRAYBAR Tag. Just call your local GRAYBAR office.**

**GRAYBAR—IN OVER 80 PRINCIPAL CITIES**

**Executive Offices: Graybar Building, N. Y.**

GRAYBAR ELECTRIC COMPANY F. 12
Graybar Building, New York

Please send me your free bulletin, "Planned Protection Can Meet This Challenge."

*Name*..... *Title*.....

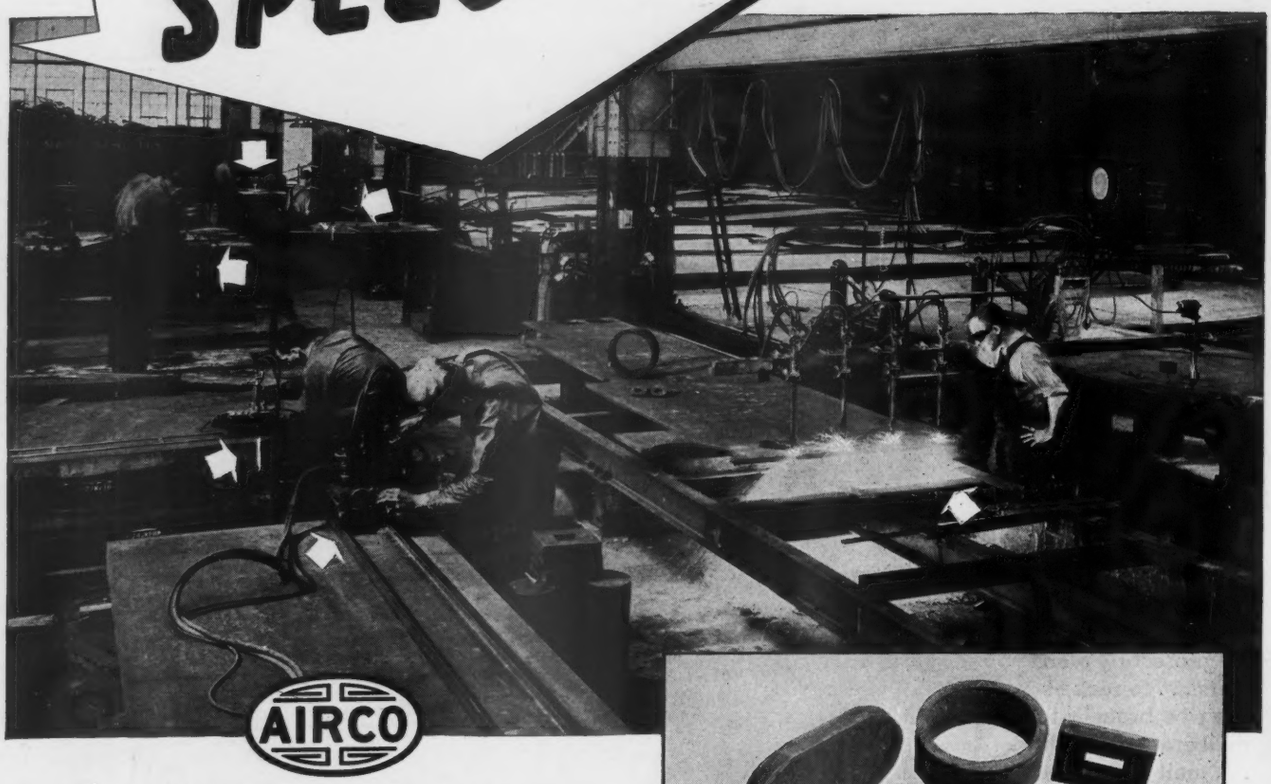
*Company*.....

*Street*.....

*City*..... *State*.....

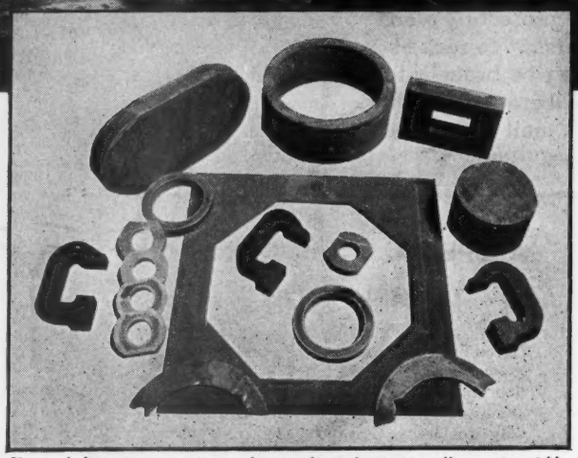
# PRODUCTION SPEED-UP

**THIS PLANT HAS THE ANSWER**




## GAS CUTTING MACHINES

Today's steadily increasing production requirements cause no delays at A. M. Castle Co., Chicago, as this picture so graphically illustrates. This plant is equipped with several types of Airco Gas Cutting Machines such as the Travographs, Oxygraphs and Radiagraphs shown in their steel warehouse speeding up production all along the line, thereby enabling A. M. Castle & Co. to render prompt and efficient service to their customers. » » You, too, may find the same answer to your production problems . . . Airco Gas Cutting Machines. There is a complete line to cover every cutting need.



*Size and shape may vary to an almost unlimited extent — all are cut quickly, at low cost, with Airco Gas Cutting Machines.*

Members of our Applied Engineering Department — through practical assistance — assure you best results in the application of these machines to your individual requirements.

# AIR REDUCTION

**General Offices:** 60 EAST 42nd STREET, NEW YORK, N. Y., DISTRICT OFFICES IN PRINCIPAL CITIES

AIRCO *Anything and Everything for* GAS WELDING or CUTTING and ARC WELDING WILSON

# Multiply Man-Power with Osborn Brushes

## *Step-up output and save on your cleaning and finishing operations*

● Scores of plants have in recent months discovered the speed and economy of Osborn Brushes for the first time. They've seen slow and sluggish hand operations mechanized at small cost—production speeded up to a new high—and a marked improvement in the quality of work. If you have a cleaning, polishing or finishing job that has failed to keep up the production pace—tool up with brushes now!

You can bring your brushing problems to Osborn with the assurance of receiving both a correct and unbiased answer. This company has lived with such problems for years and developed a complete line of brushes to meet a wide variety of needs. It not only recommends the right brushes but the right way to use them for maximum results.

There's an Osborn distributor in your territory who stocks most of the items in this complete brush line. His services, as well as those of the Osborn organization, are yours for the asking.

*THE OSBORN MANUFACTURING COMPANY* • 5401 Hamilton Avenue • Cleveland, Ohio

*Sales Offices: New York • Detroit • Chicago • San Francisco*

OSBORN

**OSBORN DISTRIBUTORS STOCK THESE OSBORN BRUSHES FOR QUICK DELIVERY TO YOU: Wire Wheel Brushes • Fibre Wheel Brushes • Wire Scratch Brushes • Paint and Varnish Brushes • Floor Sweeping Brushes • Window Cleaning Brushes • Counter or Bench Dusters • Fibre Push Brooms • Wire Push Brooms.**

# *Thorough* ATTENTION TO DETAIL

## Means Maximum Eyesight Protection and Efficiency

FROM the production of raw glass in the Bausch & Lomb Glass Plant to the final inspection of the complete B&L Safety Goggle, every detail of design and manufacture is controlled by Bausch & Lomb. Only by this thorough attention to details can maximum eyesight protection be attained.

That is why the rugged frames and optically correct, impact resisting, hardened lenses are rated so highly in actual performance tests. That is why workmen place complete confidence in the ability of B&L Safety Goggles.

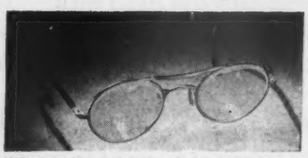
### PRESCRIPTION GROUND, HARDENED LENSES

BECAUSE a workman's efficiency is directly proportional to his eyesight, B&L Prescription Ground Hardened Lenses are invaluable for those whose eyesight needs correction as well as protection. Hardened after grinding, these lenses are not less than 3 mm. at the thinnest point. Thus maximum protection is maintained.

If you were unable to attend the National Safety Congress, a letter to Bausch & Lomb Optical Co., 650 St. Paul Street, Rochester, N. Y. will bring you complete details.

## BAUSCH & LOMB *Safety Goggles*

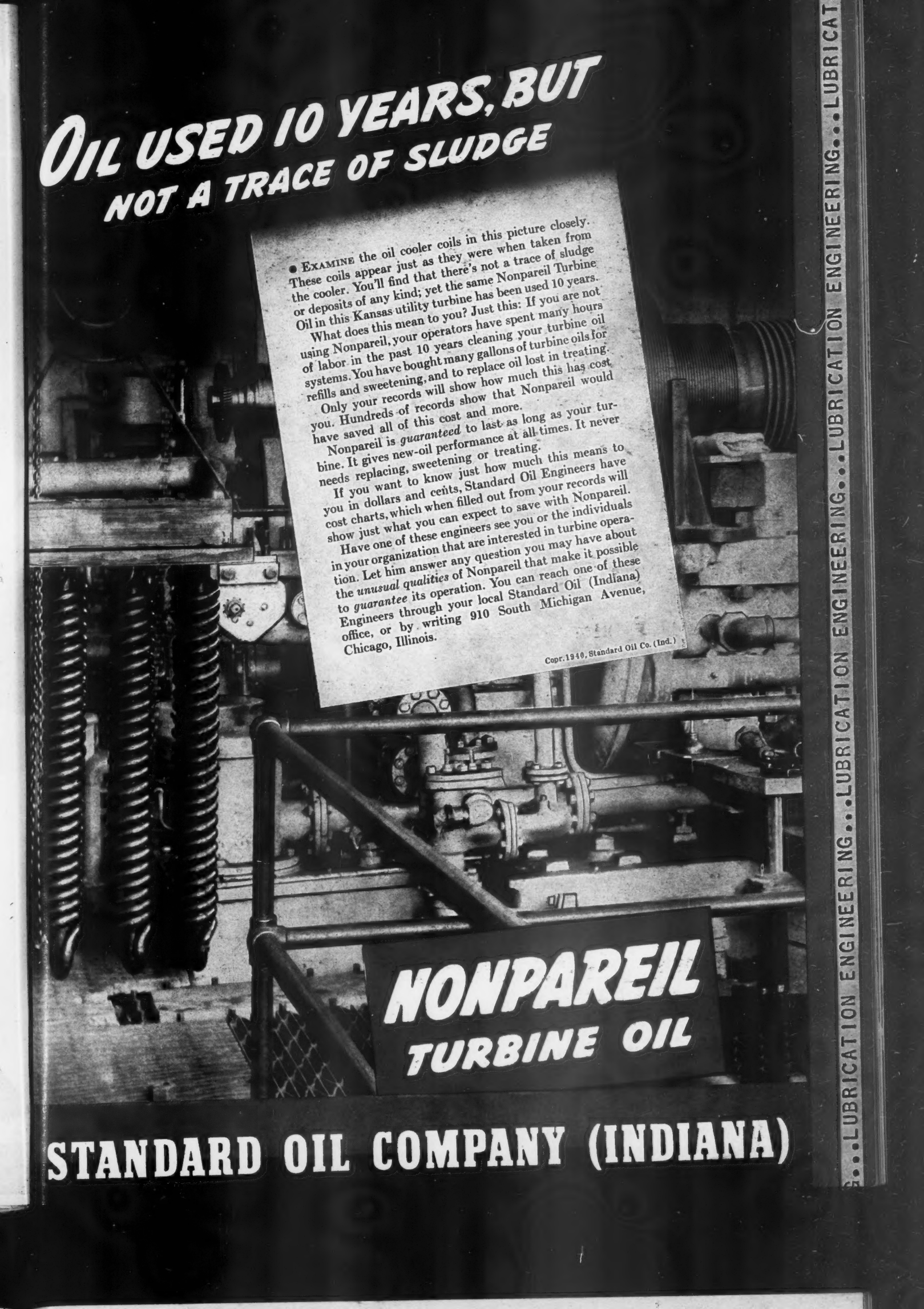
*Chip-Ban Metal Goggles*—with nose and side screens. Reinforcing bar strengthens bridge construction. All-metal or molded plastic nose pads. Clear lenses or any of 3 shades of Ray-Ban Anti-Glare lenses.



*Chip-Ban Metal Goggles*—illustrated without nose or side screens. Available with nose screen only or side screens only or both. Light weight permits wearing for long periods with complete comfort.

*Arc-Ban Molded Welding Goggles*—frame same as Chip-Ban Molded Goggles, but with baffle to exclude side flashes. Arc-Ban Welding Lenses available in 5 shades, filter out infra-red and ultra-violet radiations.

*Melters "Ohio Blue" Spectacles*—available with lenses in eight different densities, scientifically compounded for accurate temperature readings which assure greater precision in steel making. Sturdy, light-weight frames.


OIL USED 10 YEARS, BUT
NOT A TRACE OF SLUDGE
● EXAMINE the oil cooler coils in this picture closely. These coils appear just as they were when taken from the cooler. You'll find that there's not a trace of sludge or deposits of any kind; yet the same Nonpareil Turbine Oil in this Kansas utility turbine has been used 10 years.
What does this mean to you? Just this: If you are not using Nonpareil, your operators have spent many hours of labor in the past 10 years cleaning your turbine oil systems. You have bought many gallons of turbine oils for refills and sweetening, and to replace oil lost in treating.
Only your records will show how much this has cost you. Hundreds of records show that Nonpareil would have saved all of this cost and more.
Nonpareil is *guaranteed* to last as long as your turbine. It gives new-oil performance at all times. It never needs replacing, sweetening or treating.
If you want to know just how much this means to you in dollars and cents, Standard Oil Engineers have cost charts, which when filled out from your records will show just what you can expect to save with Nonpareil.
Have one of these engineers see you or the individuals in your organization that are interested in turbine operation. Let him answer any question you may have about the *unusual qualities* of Nonpareil that make it possible to *guarantee* its operation. You can reach one of these Engineers through your local Standard Oil (Indiana) office, or by writing 910 South Michigan Avenue, Chicago, Illinois.
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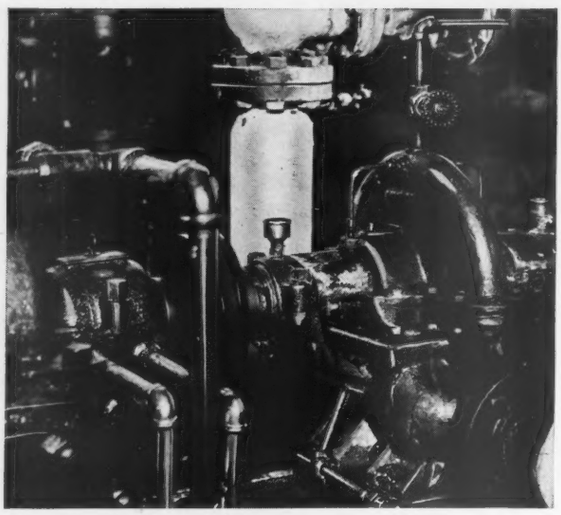
NG...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICA

## SUPERLA GREASE STOPS BEARING FAILURES IN BOILER FEED PUMP

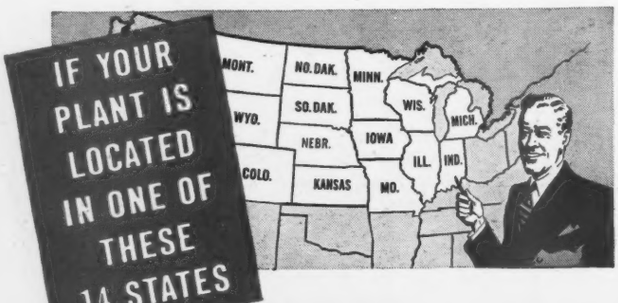
The turbine-driven boiler feed pump pictured below in a Central State institution had a large appetite for grease. A number of greases were tried, but all leaked out of the bearings rapidly and while these tests were being made bearings burned out in two instances.

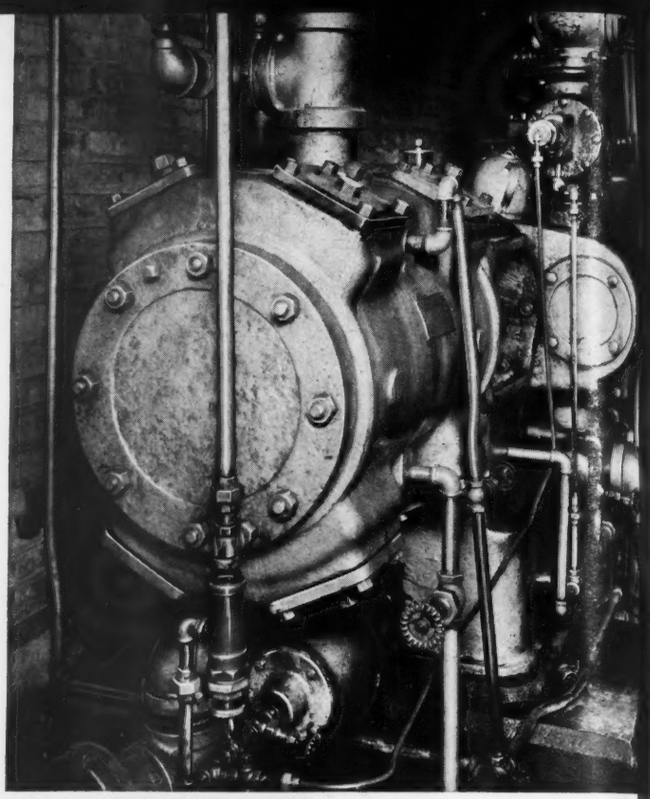
After that a Standard Lubrication Engineer was called. He analyzed operating conditions: turbine speed 3450 RPM; steam pressure 210 lbs. per sq. in.; feed water temperature 215° F. He also checked the bearings for alignment and clearance. Then he recommended Superla 2X Grease. And that ended all experimenting and bearing trouble.



## STANOIL SOLVES GEAR CASE TEMPERATURE PROBLEM

Small reduction gears on a motor driven adding machine were responsible for an undue number of service calls. It wasn't serious, but after long periods of continuous operation the gear case would become overheated. The manufacturer decided it was a problem for his Standard Lubrication Engineer. And rightly so, for after examining the gears the Engineer recommended a test of Stanoil 51. First it was tried in factory tests—temperatures remained normal. Then it was put in a few of the cases that had caused the service calls. Again Stanoil eliminated all overheating complaints.



## STANOIL CURES UNLOADER STICKING IN COMPRESSOR

The unloader on a compressor in a Michigan refrigeration plant had to be cleaned so often that the engineer decided it would become worn out just from taking it down and cleaning it. Without this frequent cleaning it would operate only a short time without sticking, even though a special air compressor oil was being used.

Without wasting any time experimenting with other compressor oils, the engineer called in a Standard Lubrication Engineer. He knew what was needed. First, the oil should have the right viscosity and maintain it under widely varying temperature conditions. Secondly, it must be free from carbon or gum forming tendencies even after long periods of operation. That oil, the Engineer knew, was Stanoil.

Stanoil was installed. Since then, the unloader on this compressor is now cleaned once every six months and sticking is unknown.

## A FAST WAY TO SOLVE YOUR LUBRICATING PROBLEMS

Because you haven't time today to spend weeks or months trying various lubricants on some troublesome lubricating job, don't neglect it. Let a Standard Lubrication Engineer help you. His first recommendation will most likely clear up the problem. Call your local Standard Oil (Indiana) office or write 910 South Michigan Avenue, Chicago, Illinois. In Nebraska write Standard Oil of Nebraska at Omaha.

Billings, Montana
Chicago, Illinois
Davenport, Iowa
Decatur, Illinois
Denver, Colorado
Des Moines, Iowa
Detroit, Michigan
Duluth, Minnesota
Evansville, Indiana
Fargo, North Dakota
Grand Rapids, Michigan
Green Bay, Wisconsin
Huron, South Dakota
Indianapolis, Indiana
Joliet, Illinois
Kansas City, Missouri
LaCrosse, Wisconsin
Mankato, Minnesota
Mason City, Iowa
Milwaukee, Wisconsin
Minneapolis, Minn.
Peoria, Illinois
Quincy, Illinois
Saginaw, Michigan
St. Joseph, Missouri
St. Louis, Missouri
South Bend, Indiana
Wichita, Kansas

YOU CAN GET STANDARD OIL ENGINEERING SERVICE

# NOW! A NEW TYPE OF SUPEREX INSULATION!

**Out of the J-M Laboratories comes this lighter, stronger, more efficient insulation for temperatures up to 1500° F.—L-W Superex**

For temperatures to 600°, J-M 85% Magnesia; to 700°, J-M Asbesto-Sponge Felted; to 1900°, J-M Superex. This has been standard insulation practice in thousands of plants.

Now, for intermediate temperatures up to 1500°, the J-M Laboratories have developed a companion product for these outstanding insulations—the new L-W Superex. Within this temperature range, L-W Superex blocks and pipe insulation provide the durability and permanence so characteristic of all J-M Insulations, with the added advantages of light weight, high strength and increased insulating efficiency.

Between 1500° and 1900°, the former Superex, now known as H-T Superex, still remains No. 1 choice for reliability and maintained efficiency in service.

Detailed information on L-W Superex is now available in engineering data sheets. For your copies and facts on the complete line of J-M Insulations, just write Johns-Manville, 22 East 40th Street, New York, N. Y.

## Johns-Manville INDUSTRIAL INSULATIONS

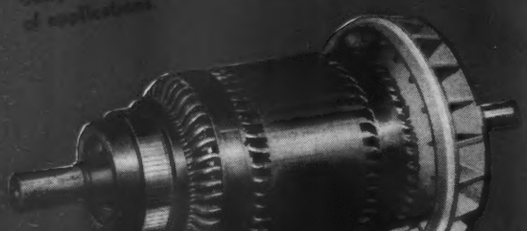
*FOR EVERY TEMPERATURE . . . FOR EVERY SERVICE . . .*

L-W Superex Blocks and Pipe Insulation . . . H-T Superex Blocks . . . Asbesto-Sponge Felted . . . 85% Magnesia . . . Sil-O-Cel C-22 Brick . . . Rock Cork . . . JM-20 Brick

# There's DOUBLE

## in the NEW FEATURES

G-E direct-current motor, Type B, typical of the smaller ratings. Additional protective features and the compact design make it readily adaptable to an increasing number of applications.

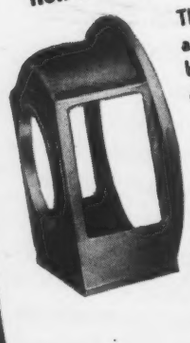


Armature is dynamically balanced. Welded end support has bold ventilation slots. Radial ducts in punchings and openings in the frame under-side that holds them, provide positive ventilation.

The armature is brazed while under high pressure. Then the copper and steel segments are drawn together under high pressure while the commutator is still hot. End (2) mold varnish applied to the end of this unit provides a smooth, streamlined surface.

G-E direct-current motor, Type CD, typical of the larger ratings.

**An improved ventilating system, designed for reversible rotation, gives positive axial ventilation through the motor.**



The same bearing bracket is used for ball and sleeve bearings, and the bearings can be removed without disturbing brush-rigging connections.

The larger motors have a new "V-type" brush holder designed for reversing service.

Split construction of the highly efficient fan scroll, which forms the drive-end bearing bracket, allows the scroll to be removed easily.

The radial-blade fan is cast-aluminum and specially designed for use in reversing service. The fan is rabbetted and bolted to the armature spider.

# PROTECTION

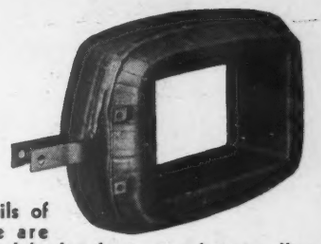
## of G-E Direct-current Motors

### Exposed Parts Protected against External Damage

**The over-all design of the open motor makes it readily adaptable for use even on jobs that have natural hazards to motor life. It not only safeguards the motor parts, but also increases safety for workmen.**

### Protected Internally against Electrical Failure

**Electrical protection is gained through the use of Formex magnet wire in the armatures and field coils, and by a final treatment of a specially developed Glyptal base insulating varnish which gives additional value to the other fine insulating materials used.**



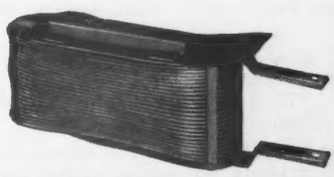
Main field coils of Formex wire are wound on spool bodies having insulating collars that insulate coil and pole from frame. Each coil is taped, dipped, and baked. A completed coil is shown above.

OTHER new features of G-E d-c motors include such improvements as cast-aluminum fans specially designed for reversing service; reversal without changing any part of the frame, fan, or brush rigging; compact assembly; more positive ventilation; lower $WR^2$; small diameter, which means low headroom needed; and interchangeability of ball- and sleeve-bearing brackets on the larger motors.

Main field pole pieces are laminated silicon steel, welded together and securely bolted to rolled-steel frame.

These and additional features which all sum up to increased all-round performance and protection are rolled-steel frames, V-type brush holders, cast-brass brush-holder boxes, accurately centered rabbet fit of precision machining, extra large conduit box, provision for lubricating and flushing of bearing while motor is running, punched commutator segments, Textolite wedges in armature slots for winding protection, and constant air gap.

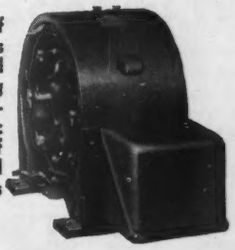
All current-carrying parts and rotating parts, except shaft extensions, can be enclosed readily for protection of operators.



Commutating coils are made of edgewise-wound copper strip with enamel turn insulation, and are insulated from the pole by a layer of laminated acetate paper.

Surely you will want to learn more about motors with such outstanding improvements. These G-E direct-current motors are being applied in increasing numbers on jobs for which standard designs formerly were not recommended. They are fully fitted to fill the bill on your jobs. Call our local office. General Electric Company, Schenectady, N.Y.

Continuous rabbet fit of rolled-steel frame assures accurate concentricity and alignment of the bearing bracket. Additional insulation protects the basic dielectric strength of Formex wire, and red Glyptal varnish protects the coils.



GENERAL ELECTRIC

# "PF"

## *Try this Electrode that's* TESTED *and* APPROVED!

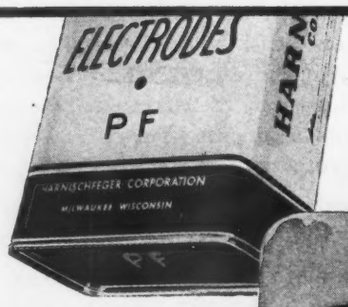
You don't have to experiment or run costly tests with an electrode like "PF". Its performance is proved by industry and approved by all important testing bodies. It's ready to give you the dependable results you want.

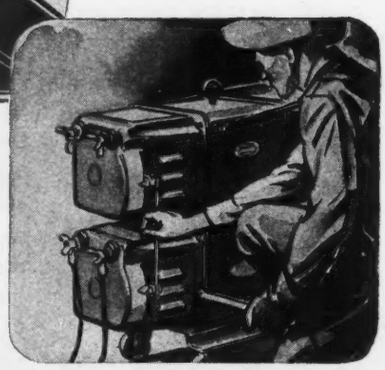
## P&H WELDING ELECTRODES

Use "PF" on mild steels, where irregular joints or poor fit demands a liberal flow of weld metal . . . on girders, ship bulkheads, pipe booms, web frames, shaft tunnels, tanks, headers, sheet metal, steel plates, etc.

"PF" works well in *all positions*. Vertical welds can be run either from bottom up or top down with very good results. With high physical properties, "PF" is easy to use with either generator or transformer type welders.

Like all P&H electrodes, "PF" is packed in air-tight containers — kept "factory fresh" to assure best results whether you use them next week or next year. You can buy them in quantities at quantity prices. Ask a representative to call and demonstrate how P&H electrodes can save you time and money.



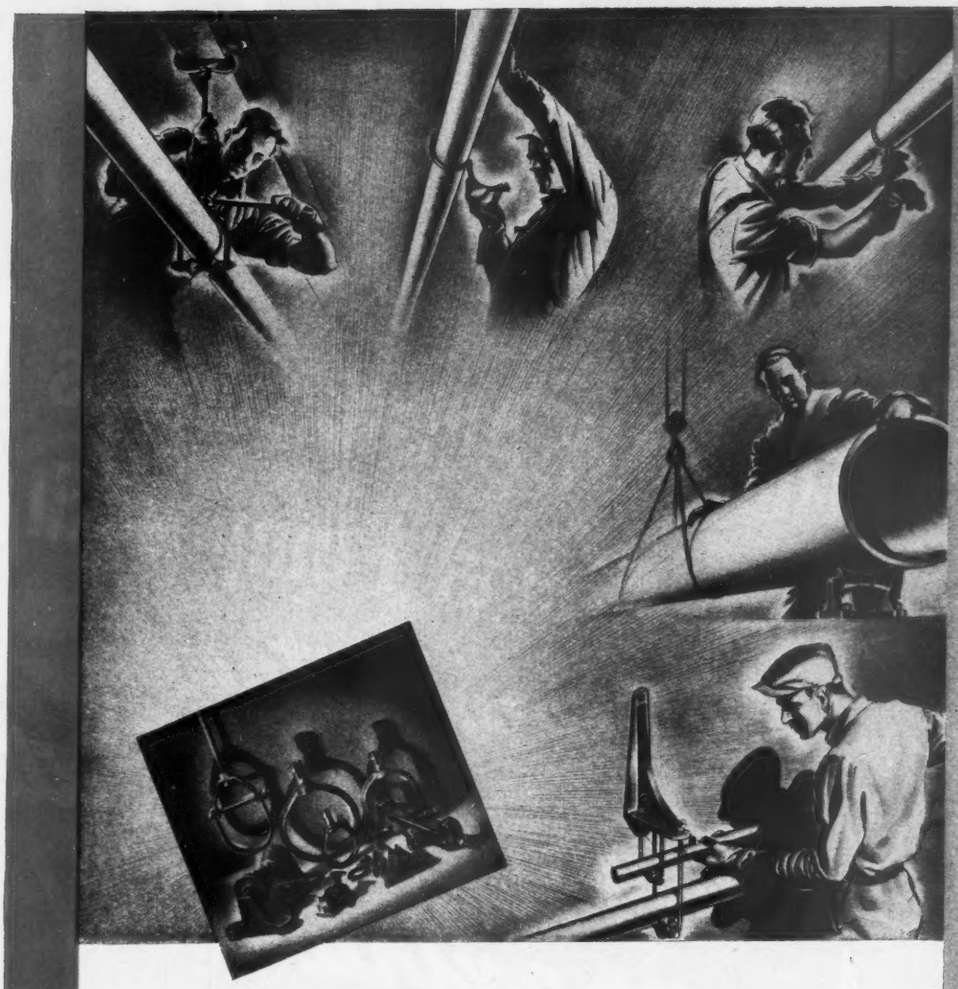
## *P&H-HANSEN* Square Frame *WELDERS*

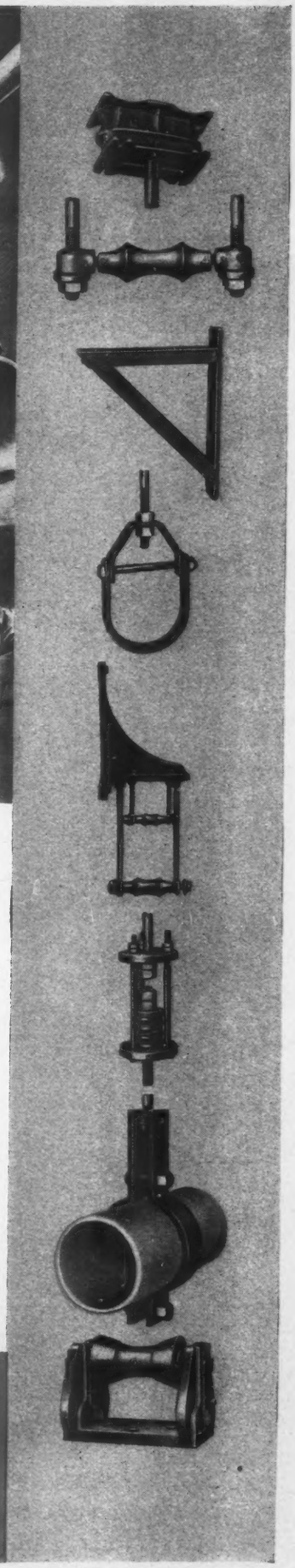
It's a sensation wherever welders are used! With one simple control, a single machine gives you any current from 200 down to 15 amps. And machines can be hooked up in parallel — in a jiffy — for their combined capacity. It eliminates the need for special, high amperage machines, keeps busy serving either one or two operators. And here's arc performance that isn't equalled. Ask us to send Bulletin W-28.

*General Offices:* 4525 West National Avenue, Milwaukee, Wisconsin

# HARNISCHFEGER
## CORPORATION

ARC WELDERS ★ EXCAVATORS ★ ELECTRIC CRANES P&H MOTORS ★ HOISTS ★ WELDING ELECTRODES





# PIPE HANGERS *engineered* for each specific service

Now you can get professionally-engineered pipe hangers for every job you have to do! No more makeshift hangers that take time and only do a half-way job . . . no sagging pipes and costly maintenance . . . Grinnell Pipe Hangers include types and styles to hang *any* piping *anywhere.* They're faster, stronger, more compact . . . and easily adjustable *after installation.*

Write for complete catalog, "Grinnell Adjustable Pipe Hangers." Grinnell Company, Inc., Executive Offices, Providence, R. I. Branch offices in principal cities of United States and Canada.

# GRINNELL

WHENEVER **PIPING** IS INVOLVED

# ANNOUNC

The NEW Allis-Chalmers Electrifugal Pump with

*... new extra value features at no extra cost!*

AC ALLIS-CHALMERS *Electrifugal*

# ING!

## Here Are Engineering Advancements That Mean More Gallons... At Less Cost to You!

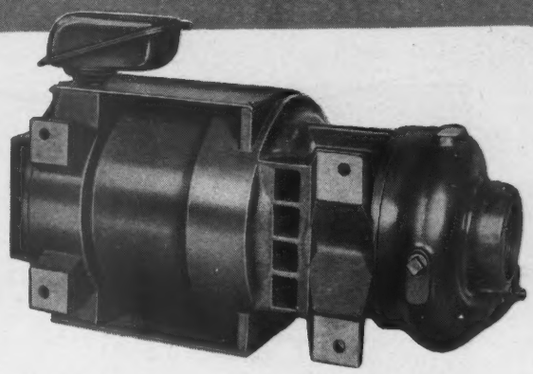
1. **All-in-One . . . Motor and Pump Designed as Unit on One Shaft and One Housing . . . Increases Compactness . . . Adds to Flexibility.**
2. **Allis-Chalmers Lo-Maintenance Motor . . . Developed Especially for This Work . . . Gives Maximum Pumping Efficiency at Lowest Power Cost . . . Built with Cast Iron Frame for Special Applications in Chemical Industry.**
3. **Splash-Proof Features . . . with Air Passages Baffled . . . Safeguard Motor from Liquids.**
4. **Fewer Parts to Wear . . . Better Fit to Parts Because of Fewer Machine Joints . . . Adds to Long-Life, Low-Cost Operation.**
5. **Indestructible Rotor . . . Distortionless Stator . . . Bronze Fitted Pump Parts . . . Large Space Provided for Adjusting Glands . . . and Other Features Assure You Improved Performance.**
6. **Greater Stability and Rigidity of All-In-One Design . . . Means Less Vibration . . . Lower Maintenance . . . Longer Life.**

THESE ARE ONLY a few of the great features that have been made a part of the new all-in-one Electrifugal Pump by Allis-Chalmers engineers . . . the same trail-blazing engineering that designed and built the gigantic Niagara Falls and Boulder Dam turbines . . . that originated the motor-coupled pump in 1926!

Here, in one unit, is the pump and motor combination you've been looking for . . . modern in appearance . . . ready to give you more gallons per dollar of power cost.

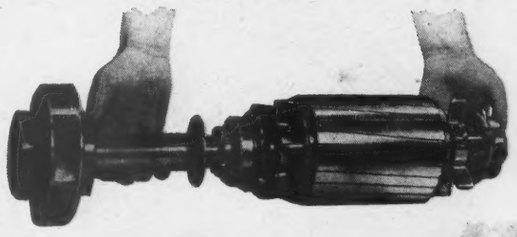
So before you buy . . . get the whole story of the new Allis-Chalmers Electrifugal Pump. Find out how well it fits into your present set-up . . . how it can save you money. Best of all — learn how you get these *extra-value features* at *no* extra cost.

Call the nearest Allis-Chalmers district office . . . or write Allis-Chalmers, Milwaukee . . . today! A-1300



IN THIS UPSIDE-DOWN VIEW OF THE Electrifugal Pump, see how the air goes in and out through large air passages, keeping the motor cool at all times.

THIS DISTORTIONLESS, REMOVABLE Stator is one of the many outstanding features of the Allis-Chalmers Lo-Maintenance Motor used as integral part of the Electrifugal Pump.



INDESTRUCTIBLE ROTOR IS on the same shaft with pump runner — making a single unit of pump and motor . . . with lower maintenance and longer life.

THE ALLIS-CHALMERS ELECTRIFUGAL Pump has bronze runner wear rings, water seal ring, and shaft sleeve . . . has been designed to deliver maximum gallons at minimum cost.

PUMP *Cuts your Pumping Costs!*

# *Something* NEW

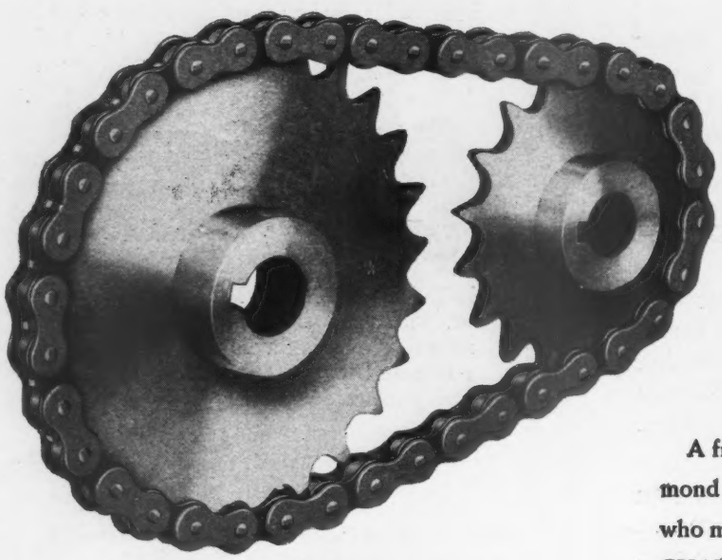
## A Smaller, Lighter Weight Roller Chain
## 0.315 in., (8mm) Pitch

**Actual Size—*192 INDIVIDUAL PARTS IN TWELVE INCHES OF CHAIN***

**SPECIFICATIONS**

| | | | |
|---|---|---|---|
| **Pitch** | **—0.315 in. (8 mm)** | **Pin Diameter** | **—0.0905 in.** |
| **Roller Diameter** | **—0.197 in.** | **Weight per foot** | **— 1.75 ounces** |
| **Inside Width** | **—0.125 in.** | **Tensile Strength** | **— 1100 lbs.** |

A featherweight—twelve inches weighing only 1¾ ounces, one link only .0459 ounces—this sturdy little chain will transmit power quietly and smoothly, at still higher speeds than the larger sizes of standard Diamond Roller Chains, —⅜" to 2½" pitch inclusive—with the same high efficiency and the same sure, non-slip, non-creep advantages.

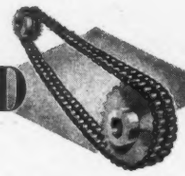


*Full size picture of 1½:1 reduction drive on 2.56" centers. Capacity of this drive:— ½ h.p. at 1800 r.p.m. • 1 h.p. at 3600 r.p.m.*

The wide range of utility of Diamond Roller Chain Drives is still further extended by this new chain. All the advantages of Diamond Roller Chain Drives are provided in a still smaller "package"—more compact, lighter in weight, extremely short shaft centers.

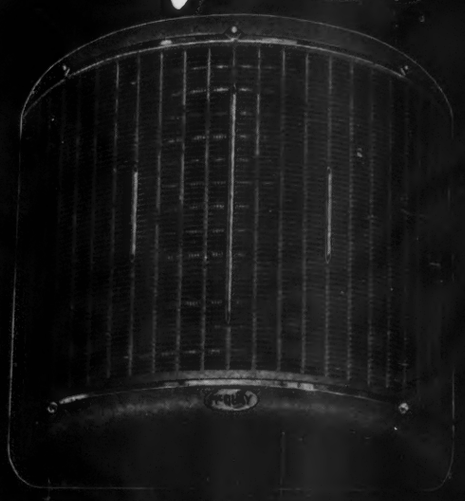
Fifty years of specializing in the manufacture of one product—Diamond Roller Chain Drives—have made it possible to build the same quality and endurance into this extremely small chain that are characteristic of the larger sizes. "Built like a watch" is not just an idle statement—the 192 individual parts in one foot of chain are made with such accuracy that the total length tolerance is plus .0156 minus .000".

A free sample of this new lightweight and smaller Diamond Roller Chain (Model No. 88) will be sent to those who may be interested in its possibilities . . . DIAMOND CHAIN & MFG. CO., 449 Kentucky Avenue, Indianapolis, Indiana. Offices and Distributors in All Principal Cities.

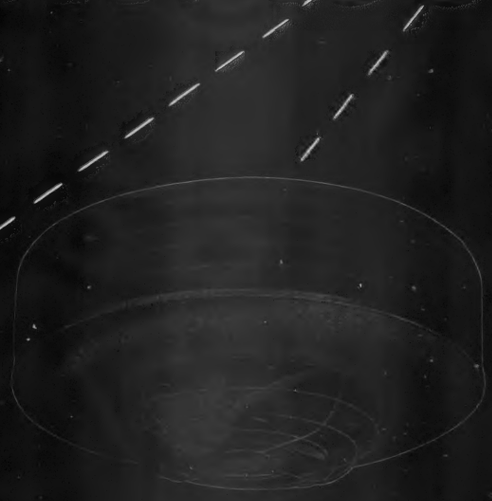
**DIAMOND**  **ROLLER CHAINS**

**50TH ANNIVERSARY • 1890-1940**

# AS *Good* AS THEY LOOK



RADIAL TYPE UNIT HEATER



DOWN FLOW UNIT HEATER

CABINET TYPE UNIT HEATER

BLOWER TYPE UNIT HEATER (FLOOR)

STANDARD UNIT HEATER

BLOWER TYPE UNIT HEATER (SUSPENDED)

GAS FIRED UNIT HEATER

**McQuay designers have given new beauty to Unit Heaters. The handsomely styled McQuay Line has real eye appeal, and more than that, McQuay Unit Heaters are as good as they look. • The McQuay Down Flow reclaims wasteful "stratified heat" and forces warmed air down into the working zone over a wide area. • The new Radial Type, an exclusive McQuay development, provides wide uniform heat distribution, lower installed cost and new economy of operation. One Radial Heater can be used in place or two or more standard units, providing lower installed cost and effecting important savings in piping expense as well. • McQuay and only McQuay offers a complete line of Unit Heaters. There is a Unit Heater for every application. • The new McQuay catalog describes this complete line and shows you its many definite advantages. Write McQuay, Inc., 1620 Broadway Street, Minneapolis, Minnesota. Representatives located in all the principal cities.**

McQuay INC.

*Air Conditioners . . . Air Conditioning Coils . . . Blast Coils . . . Blower Coolers . . . Comfort Coolers . . . Cabinet Radiation . . . Concealed Radiation . . . Evaporative Condensers . . . Indoor Cooling Towers . . . Ice Cube Makers . . . Icy-Flo Accumulators . . . Refrigerating Coils . . . Room Coolers . . . Unit Heaters . . . Unit Coolers . . . Water Cooling Units*

# IN APRIL WE ANNOUNCED

# DRASTIC PRICE REDUCTION

## on G-E Midget Metal-clad Switchgear

## BASED ON ANTICIPATED DEMAND

NOW you can give circuits up to 5000 volts the same dependable protection used for higher-voltage, high-capacity circuits—and at lower costs than ever before. Recent price reductions on G-E Type MI-9 metal-clad switchgear make available to every industrial plant and public building the economy, safety, and convenience obtainable only with G-E vertical-lift metal-clad.

We have made this price reduction because we are certain that there is a wide need for this equipment in all classes of industry. The new low prices are based on anticipated quantity production of standard units. We are confident that increased sales volume will justify this price reduction.

### How About YOUR Plant?

Are you sure of the protection on your incoming lines, power feeders, and motor circuits? Or are you gambling that obsolete, inadequate equipment will get by?

Are you sure that your operators are not taking chances—on the safety of both personnel and equipment—by depending on switchgear that has not kept pace with the growing needs of industry? Many such situations are being corrected by the installation of vertical-lift, metal-clad switchgear.

### Completely Factory-assembled

Wide field service and actual operating experience in industry have proved G-E Type MI-9 metal-clad switchgear to be the ideal equipment for service up to 5000 volts, 50,000 kva interrupting capacity. It consists of a completely fabricated, factory-assembled unit, containing circuit breaker, insulated buses and connections, disconnecting devices, sturdy mechanical interlocks, and instrument transformers where required—delivered as a unit ready to put into service, with low (predictable) installed cost.

Get the complete story of this modern shipped-assembled, metal-clad switchgear. Just call the nearest G-E office, or ask for a copy of our new descriptive bulletin, GEA-2249C.

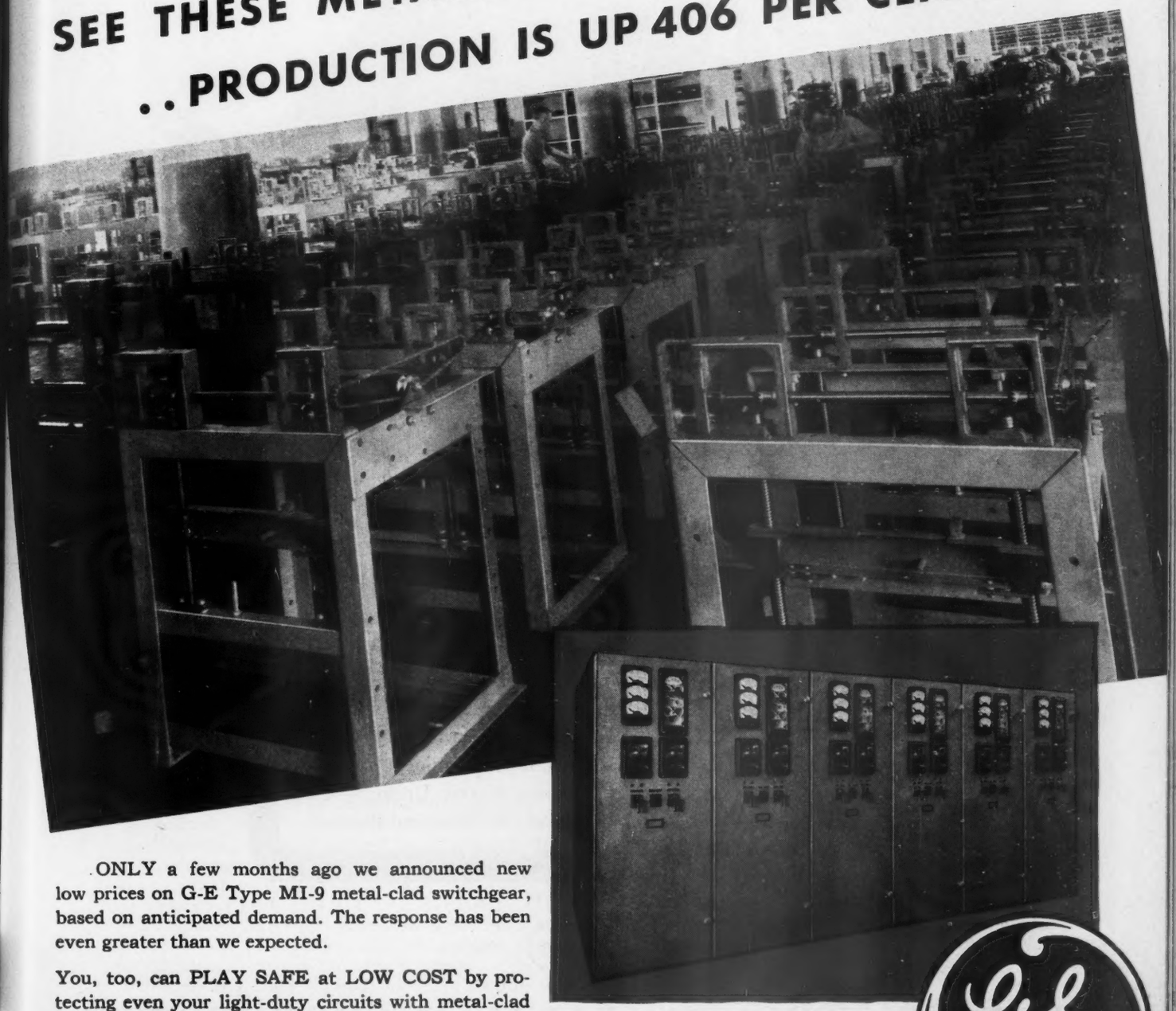
THE VALUE OF THE MI-9

Black
Light Bron
Dark Bron

GENERAL

# AND TODAY

## SEE THESE METAL-CLAD ASSEMBLY LINES .. PRODUCTION IS UP 406 PER CENT



ONLY a few months ago we announced new low prices on G-E Type MI-9 metal-clad switchgear, based on anticipated demand. The response has been even greater than we expected.

You, too, can PLAY SAFE at LOW COST by protecting even your light-duty circuits with metal-clad switchgear. Get the advantages of removable breakers for easy inspection . . . drawout relays, which are always accessible and easy to test . . . and the many other features for reliability and safety. General Electric, Schenectady, N. Y.

▲ Here is a typical Type MI-9 equipment ready for installation. Hundreds of similar standard metal-clad units now in the process of assembly are shown in the large picture above.

GE

GENERAL ELECTRIC

# *Silence is Golden*

## Because it means dividends to the air lines!



*Quiet* comfort and relaxation for the passengers is assured by the use of Felters Kapok Unisorb in this Lockheed "LODESTAR". Like Lockheed, most prominent airplane manufacturers use Kapok Unisorb—the lightest and most efficient sound absorber.

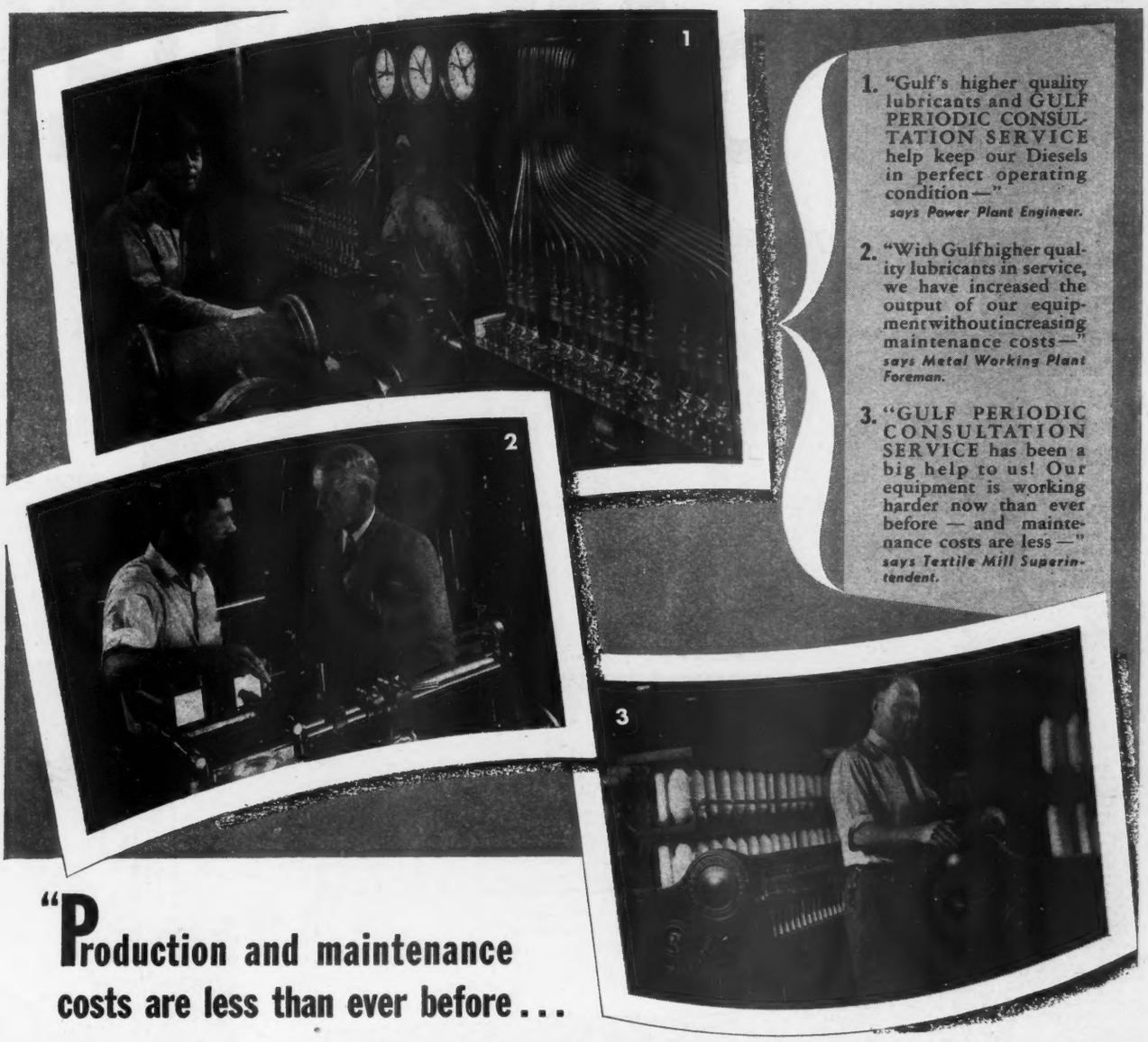
*Look For* CERTIFIED FELT Made by The FELTERS COMPANY INC. *This Label*

## THE FELTERS COMPANY, INCORPORATED

**210 SOUTH STREET, Dept. G-12 • • BOSTON, MASSACHUSETTS**

*OFFICES: New York, Philadelphia, Chicago, Detroit* *SALES REPRESENTATIVES: Dallas, Los Angeles, Nashville, St. Louis, St. Paul*
*MILLS: Johnson City, New York • Millbury, Massachusetts • Jackson, Michigan*

F E L T E R S F E L T F U N C T I O N S




1. "Gulf's higher quality lubricants and GULF PERIODIC CONSULTATION SERVICE help keep our Diesels in perfect operating condition—" *says Power Plant Engineer.*

2. "With Gulf higher quality lubricants in service, we have increased the output of our equipment without increasing maintenance costs—" *says Metal Working Plant Foreman.*

3. "GULF PERIODIC CONSULTATION SERVICE has been a big help to us! Our equipment is working harder now than ever before — and maintenance costs are less —" *says Textile Mill Superintendent.*

# "Production and maintenance costs are less than ever before...

## *despite heavy working schedules! Thanks to the 100% workability of* GULF PERIODIC CONSULTATION SERVICE"

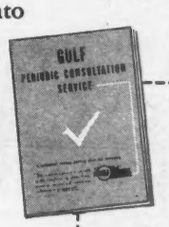
***... say Operating Officials***

TODAY'S upturn in manufacturing activity has brought to light the highly profitable advantage of controlling production costs by guarding maintenance expense. *Here's how many operating officials have secured maximum efficiency of machinery and equipment in their plants:* GULF PERIODIC CONSULTATION SERVICE is providing the extra margin of protection needed to offset the ravages of wear on machinery taxed to production limits.

If mounting costs of production are cutting into your profits and if you want to keep a close check on lubrication efficiency in your plant—call in a Gulf engineer. His experience with equipment similar to yours fully qualifies him to step in and work with your operating men to reduce controllable costs.

Gulf's higher quality oils and lubricants are quickly available to you through 1100 Gulf warehouses located in 30 states from Maine to New Mexico. Write or 'phone your nearest Gulf office today.

GULF INDUSTRIAL LUBRICATION




This booklet will suggest to you a practical method by which you can reduce operating and maintenance costs for your Diesels. Write for your free copy.

Gulf Oil Corporation · Gulf Refining Company
3813 Gulf Building, Pittsburgh, Pa.

Please send me my copy—no charge—of the booklet "GULF PERIODIC CONSULTATION SERVICE."

Name.....

Company.....

Address.....

# SAVE FUEL

## CHECK THESE FEATURES BEFORE YOU BUY

### REDUCED POWER WITH EFFICIENT AIR HANDLING

The multiple Multivane Fans with scientifically developed blade design provide low tip-speeds and permit the use of low horsepower motors.

### UNIFORM HEAT IN ALL ROOM AREAS

Because each heater is a complete unit and can be installed on the floor, wall or ceiling—they can be so placed to create efficient circulation and avoid wasteful overheating in the upper areas.

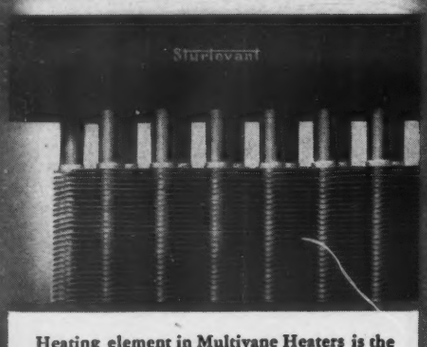
### QUIET IN OPERATION —NO FAN NOISE

To reduce noise and vibration to a minimum, every fan wheel is carefully balanced both statically and dynamically before it leaves the factory.

### COMFORTABLE HEAT NEAR THE UNIT

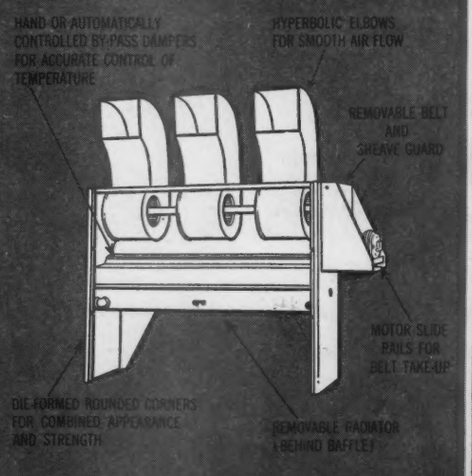
The large volume of air handled plus low output velocity result in a comfortable final temperature, even for persons stationed close to the heaters.

### LEAKPROOF HEATING ELEMENT




Heating element in Multivane Heaters is the famous Sturtevant Extended Surface Coil with welded joints throughout—guaranteed to withstand working steam pressures up to 200 lb. Coils are tested with a hydrostatic pressure of 1000 lb. per sq. in.

### 6 OTHER DESIGN FEATURES


HAND OR AUTOMATICALLY CONTROLLED BY-PASS DAMPERS FOR ACCURATE CONTROL OF TEMPERATURE
HYPERBOLIC ELBOWS FOR SMOOTH AIR FLOW
REMOVABLE BELT AND SHEAVE GUARD
MOTOR SLIDE RAILS FOR BELT TAKE-UP
DIE-FORMED ROUNDED CORNERS FOR COMBINED APPEARANCE AND STRENGTH
REMOVABLE RADIATOR (BEHIND BAFFLE)

### SPECIAL LOW-SPEED FANS

"Heart" of this heater is the famous Sturtevant Multivane Fan specially designed for air conditioning work. Notable improvements are:—High efficiency, unusually quiet operation and the production of large volumes of air at low speed.

# this Winter

## with Sturtevant's new MULTIVANE HEATER

THROUGH the adoption of Unit Heating, progressive manufacturers have not only heated their plants more efficiently—but also, *more economically!*

Now, with a further improvement in design, this new Sturtevant Multivane Heater offers you still further savings in fuel and power.

Here is how it works. Specially designed fans handle larger volumes of heated air. Slow speed rotation with belt drive permits the use of standard *stock* motors—and results in quiet operation.

Even more important—because it creates efficient circulation and thus keeps the entire area evenly and adequately heated—wasteful overheating of local areas is avoided. Better diffusion of heat results in lower fuel bills.

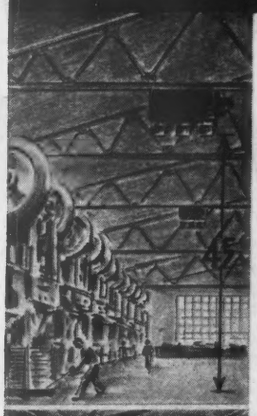
In use, "Multivane" Heaters are exceedingly flexible because they can be installed on the floor, fastened against the wall or hung suspended from the ceiling.

Don't forget, it's good business to eliminate cold-spots and draft-swept areas that keep workers shivering. That is why we say, don't delay. Investigate Sturtevant Multivane Heaters now.

B. F. STURTEVANT COMPANY • HYDE PARK • BOSTON, MASS.
*Branch Offices in 40 other cities . . . B. F. Sturtevant Company of Canada, Ltd., Galt, Toronto, Montreal*

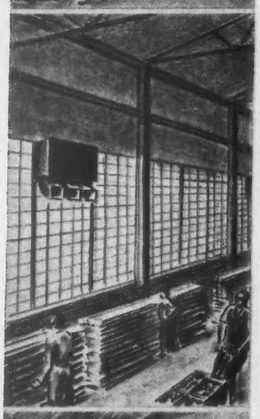
**Sturtevant**
REG. U. S. PAT. OFF.
*Puts Air to Work*

SPECIALLY DESIGNED FOR BUILDINGS LIKE THESE—



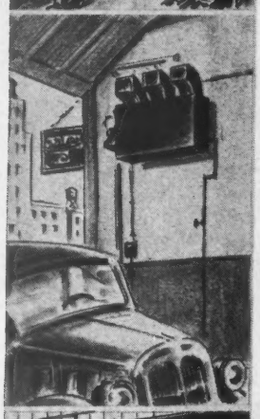
### High Ceilings

A mammoth automobile plant found it highly efficient to install Sturtevant heaters upside down on ceiling trusses, with the outlets 45 feet above the floor line!



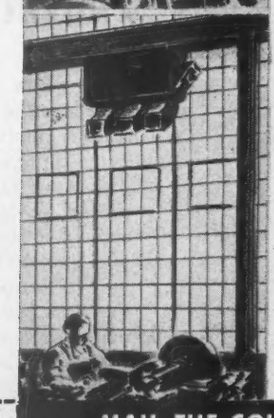
### Large Floor Areas

Stock and shipping room of a large Eastern manufacturer is 460 feet long and 60 feet wide—yet 8 Sturtevant Units handle the entire heating job!



### Frequently Opened Doors

A nation-wide chain of Super-Service Stations licked this problem by spotting Sturtevant heaters at open doors to kill cold . . . before it could sweep by!



### Large Window Areas

A large industrial plant with windows 18 feet high found this no problem for Sturtevant Heaters—with their large heating capacities and special distribution nozzles!

## ACT NOW . . .

It is not too late to do something about a heating system that will cut last winter's fuel bills. You can put in Sturtevant Multivane Heaters quickly—without interrupting production.

If you are a plant engineer, architect, consulting engineer, contractor or industrial executive—you will want to investigate this important advance in heater design. Our 24 page Multivane Heater Catalog gives complete information.

MAIL THE COUPON—TODAY!

B. F. STURTEVANT COMPANY F.M.M. 12-40
Hyde Park, Boston, Mass.

I am interested in your new Multivane Heater for the following applications:—

---

☐ Send me a copy of your new 24 page catalog describing this improved Heater.

☐ Have your local Sales Engineer call.

*Name*.....*Title*.....

*Company*.....

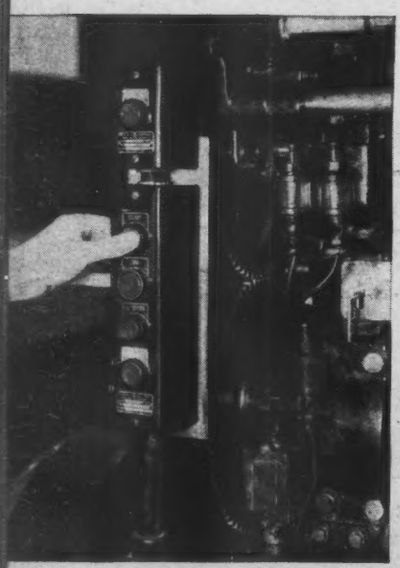
*Address*.....

# 5 WAYS TO IRON OUT

## CENTRALIZED CONTROL FOR CONTINUOUS OPERATION

Here's control that's the "brains" of a mid-west coal-washing tipple. If any one drive should shut down, stopping a conveyor, shaker, or pump, all drives supplying coal to this point will be shut down automatically to prevent a costly "pile-up." *G-E combination starters* do the job by special interlocking. Centrally located, they make it possible to quickly return the plant to operation when the trouble is cleared. User claims they're safer and cost less to install than separate devices.

**1** **G-E combination starters have motor circuit switch and fuses (or circuit breaker) plus magnetic starter with overload protection, all in a single safety-interlocked enclosure.**



## ANOTHER PUSH BUTTON MAY SAVE DOZENS OF STEPS

No waste motion for this printing-press operator as he jogs the roll. A conveniently located push-button station eliminates lost motion in set-up operations—frees the press for extra hours of running time each day. This is an example of the many ways that a simple control device, properly applied, can make possible substantial savings over a period of years. Perhaps you, too, have motor-driven equipment that would be more efficient if controlled from more than one point.

**2** **New inexpensive standard-duty push-button stations are easy to install—may save many times their cost.**

***INCREASED PRODUCTION REQUIRES THE EFFICIENCY AND SAFETY OFFERED BY MODERN AUTOMATIC CONTROL***

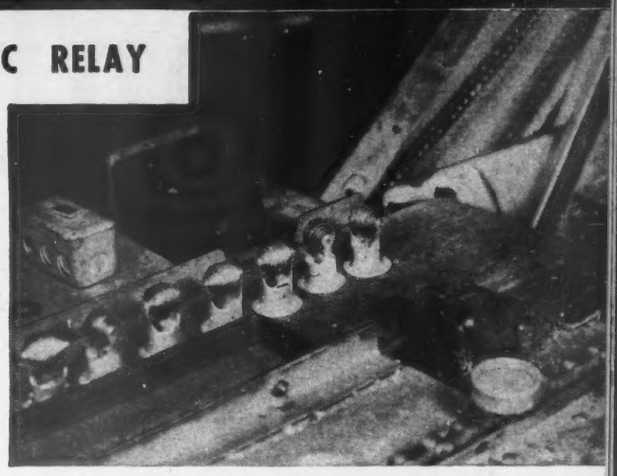
# PRODUCTION KINKS

## KNOW YOUR OUTPUT—PUT IN A PHOTOELECTRIC RELAY

3

Inexpensive photoelectric relay suitable for counting, limiting, sorting, and similar work.

A progressive valve manufacturer put a *photoelectric relay* on each of the many assembly tables to record output by means of a magnetic counter. Perhaps such a control could help you keep track of production. The counter can be located in your office.

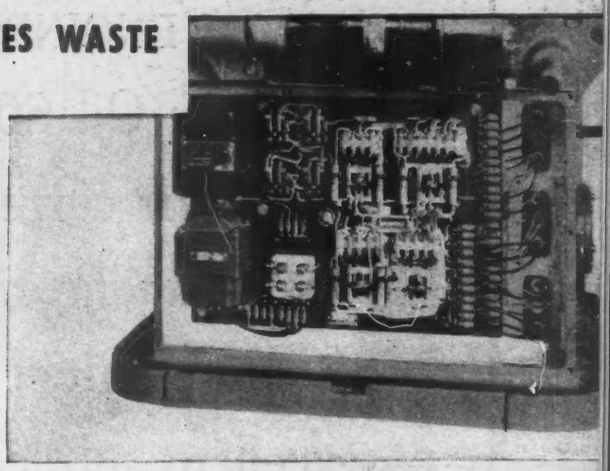


## AUTOMATIC PROCESS TIMING BOOSTS OUTPUT—SAVES WASTE

4

Timers and time switches, available for process jobs, weld timing, and other purposes, save time and money.

A Chicago valve manufacturer until recently "ground in" valve stems and seats by having each machine operator "time" the 30-second operation from a clock. Installing automatic timing made clock watching unnecessary—produced a more accurate product, and allowed the operator to perform other operations during the 30-second interval.

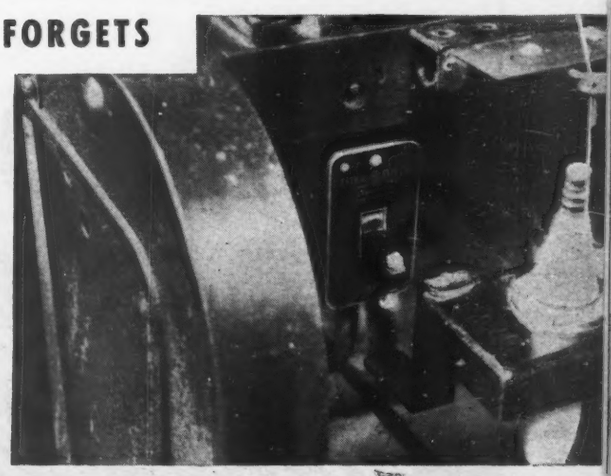


## INSTALL A LIMIT SWITCH—IT NEVER FORGETS

5

'G-Elever-and-gear-type limit switches are available for every type of application.

Wasting material by under- or over-filling the bobbins is impossible on this textile spinning frame. When bobbins are filled just right, the rail trips the limit switch, shutting off the machine until the operator can change bobbins. Perhaps this is a tip that can save you material and time.



GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

GENERAL ELECTRIC

670-22

## GARGOYLE SUPER CYLINDER OIL 600-W

# Won't Come Out In the Wash!

STEAM ENGINE OPERATORS find Gargoyle Super Cylinder Oil 600-W stays put on cylinder walls. This oil is correctly compounded so that it will not wash out, no matter what water conditions exist in your engine. Its natural oiliness makes possible excellent lubrication with extremely small feeds.

## CALL IN Socony-Vacuum for

*You'll Profit from these "Exclusives"*

☞ **SKILLED LUBRICATION COUNSEL** of a Socony-Vacuum man backed by 74 years' experience... the greatest in the Petroleum Industry.

☞ **A COMPLETE LINE** of Lubricants ... the scientifically correct lubricant for every type of machine you now own ... or will buy.

# Correct Lubrication—

☞ **NEW LUBRICANTS** ahead of new needs . . . developed in close cooperation with machine builders by famous Socony-Vacuum laboratories.

☞ **HALF A MILLION CASE HISTORIES** to guide our engineers in recommending the right use of these lubricants to earn Lubrication Profits for you.

☞ **DISTRIBUTION** throughout the world of high-quality lubricants.

• • •

SOCONY-VACUUM OIL CO., INC.
Standard Oil of New York Division • White Star Division • Lubrite Division • Chicago Division • White Eagle Division • Wadhams Division • Magnolia Petroleum Company • General Petroleum Corporation of California

GARGOYLE
Lubricants

*(Left) Crane sanitary urinals of vitreous china with integral flushing rims. Vitreous china tanks with* Alert *automatic flushing valve permit regulation of flush to any interval desired.*

*(Below) A battery of Crane heavy-duty* Santon *siphon jet closets with* Delta *water-saving flush valves and* Vigilant *vacuum breakers to prevent back-siphonage.*

# THE TIME SAVED ON MY FLOOR ALONE WAS AMAZING...!

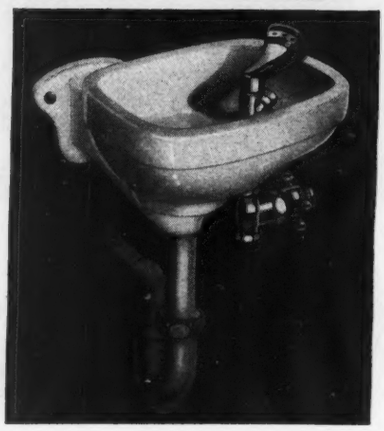
***Now we know what inadequate plumbing in the plant was actually costing us. Take my department alone, with sixty operators —when anyone left his machine, it stood idle while he crossed the whole floor twice to get a drink. Why, the men even waited their turns in the toilet rooms! It's actually surprising the extra man-hours we're getting since we modernized!***

IN these times—when every minute of productive time saved is worth double, it's wise to evaluate sanitary facilities in your plant. Ask yourself these questions: is pure drinking water *conveniently* available; are fountains placed to minimize workers' absence from machines or bench, and to reduce floor traffic? Are toilet fixtures sufficient to handle increased personnel? Are washrooms adequate and safe to encourage proper health habits—to help build employee goodwill?

Your answers will clearly show the waste of out-dated, deficient plumbing. You'll quickly see the wisdom of modernizing with up-to-date sanitary equipment.

Your best judgment will suggest remodeling with Crane-Equipment. Why? Because Crane Industrial Plumbing is designed for hard factory usage. Exclusive construction features keep maintenance cost at rock bottom; they provide utmost sanitation, safety, and convenience for users.

It costs no more to modernize with Crane plumbing; and you're sure of getting the right equipment. Crane has studied industrial sanitation needs for years; the findings are applied in designing every fixture. The Crane booklet, "Plumbing for Industrial and Commercial Buildings" shows how you can profit from Crane experience. Write for a copy today—it's free!



*In plants equipped with these handy Crane No. C9161* Thurstend *fountains, thirst is safely satisfied.* Newera *angle stream jet protects against contamination. Vitreous china receptor is easily kept clean. Self-closing valve conserves water. Light and compact—requires only 10 x 12 in. space.*

1940 OUR 85th YEAR

# CRANE

CRANE CO., GENERAL OFFICES:
836 S. MICHIGAN AVE., CHICAGO

*VALVES • FITTINGS • PIPE*
*PLUMBING • HEATING • PUMPS*

NATION-WIDE SERVICE THROUGH BRANCHES, WHOLESALERS, PLUMBING AND HEATING CONTRACTORS

# A "Rubber Railroad"

## 10 MILES LONG!

### —world's lowest-cost transportation system

THE great installation you see here is one of the world's most spectacular engineering feats — the longest conveyor belt transportation system ever built! Ten miles long in all, this giant "rubber railroad" is the main line for transporting construction supplies to the great Shasta Flood Control Dam. Designed by the G.T.M. —Goodyear Technical Man— it beelines across wastelands, bridges rivers, climbs over a range of hills 1,350 feet high, carrying a peak capacity load of 22,000 tons per day. In four years it will deliver 10,000,000 tons of sand, gravel and crushed stone—*at far lower cost per ton than any other haulage method!* This mammoth conveyor is the outgrowth of other historic installations ranging from one to five miles in length that have proved the unrivaled economy of belt transit in handling huge tonnages over terrain where other transportation does not exist or costs prohibitively. If you have such a problem, consult the G.T.M. Write Goodyear, Akron, Ohio, or Los Angeles, California—or phone the nearest Goodyear Mechanical Rubber Goods Distributor.

THE GREATEST NAME IN RUBBER
GOODYEAR

# *Call Scully*

## AND RELAX!

"An order was received at noon Saturday," says our Newark Warehouse, "with request to deliver in Corning, N.Y., not later than Tuesday morning. It was for large C. B. Sections and was immediately shipped by railroad. It was at customer's siding in Corning on Monday morning before the plant opened. The customer was enthusiastic about the way his order was handled."

YOU can rely upon Scully to handle your orders promptly, accurately and cheerfully . . . whether large or small, regular or rush. So whenever you need steel or steel products, copper or brass, put it up to Scully and know that you'll get prompt action. Thousands of customers have learned that Scully Service is the same at each of our eight conveniently located warehouses. They all operate on the principle that our customers want immediate service and friendly contacts — and they always hurry whether you ask it or not. And when you say "Rush" they know you mean it.

Why not try Scully Service? Phone, write or wire the warehouse nearest you. And ask for our complete and handy Stock List and Reference Book. It's free.

**Scully Service**

*The Mark of Service*

ALLOYS
ANGLES, HOT ROLLED and COLD ROLLED
ARCHES (CORRUGATED)
BABBITT
BANDS and HOOPS
BARS, HOT ROLLED
ALLOYS (HR and CF)
COLD FINISHED
ELECTRIC HIGH CARBON STEEL
REINFORCING
BEAMS and C. B. SECTIONS
BEEF RAIL
BOLTS, NUTS, WASHERS, ALL KINDS
BORING and TURNING BARS and GRINDERS
BRACES, BOILER
CHAIN, ALL KINDS
CHANNELS
CHISELS
CHUCKS, STAYBOLT
CLAMPS, BOILERMAKERS
CLIPS, PATTERSON
CLEANERS, FLUE
CONDUCTOR PIPE
COPPER and BRASS
COUPLINGS, HOSE
CRAYONS, SOAPSTONE
CUTTERS
DARDELET RIVET and MACHINE BOLTS
DRILL RODS
EAVE TROUGH and FITTINGS
EXPANDERS, FLUE
FERRULES, COPPER
FLANGES, BOILER and TANK
FLOOR PLATES
GALVANIZED SHEETS, BARS, BANDS
HANDLES, HAMMER
HEADS, TANK and FLANGE
HOISTS, HAND and POWER
IRON, STAYBOLT
LUGS, BOILER, TANK and SILO
MACHINERY, HAND and POWER
MANHEAD PLATES and FITTINGS
NAILS
PACKING
PAINT STICKS
PLATE STEEL, STANDARD QUALITIES
ABRASION RESISTING
COR-TEN and MAN-TEN
PLUGS, FLUE
RAILS and FITTINGS
REAMERS
SHAFTING
SHEETS
ABRASION RESISTING
ELECTRICAL
COR-TEN and MAN-TEN
HOT ROLLED and UNIFORM BLUE
WELLSVILLE POLISHED
COLD ROLLED
STAINLESS STEEL
GALVANIZED and GALVANNEALED
LONG TERNE
CORRUGATED
U-S-S COPPER STEEL
SPRING STEEL BARS and SHEETS
STAINLESS STEEL
STRIP STEEL, CR and HR
TEES
TIRE, ROUND EDGE
TOOLS, HAND and POWER for BOILER and IRON WORK
TROLLEYS
TUBES, BOILER
TURNBUCKLES
VALVES, BLOW-OFF
WELDING ROD and WELDERS
ZEES

*The Mark of Quality*

USS

*We have big stocks on hand* **NOW** *. . . for immediate delivery*

**SCULLY STEEL PRODUCTS COMPANY**

*Distributors of Steel, Steel Products, Copper and Brass*

*Warehouses at* **CHICAGO · NEWARK, N. J. · ST. LOUIS · BOSTON**
**ST. PAUL-MINNEAPOLIS · CLEVELAND · PITTSBURGH · BALTIMORE**

**UNITED STATES STEEL**

Designed, built and tested as a Gearmotor
WESTINGHOUSE DOUBLE-REDUCTION GEARMOTOR
Building both gears and electric drive in its own plants enables Westinghouse to furnish gearmotors that will handle full motor torque.
POSITIVE SPLASH LUBRICATING—assures trouble-free operation of drive.
SPLIT CASING—gives easy access to rotating parts.
SLOW SPEED SHAFT—delivers exact hp and speed required.
COMPACT MOUNTING—readily installed in small space.
ROLL BEARINGS—cut friction losses to minimum.

In the design and construction of Westinghouse Gearmotors, Westinghouse engineers do not consider the reduction gears and the electric drive as separate units. A Westinghouse Gearmotor is designed, built and tested as a complete slow speed drive —a drive in which all parts are matched to provide maximum performance. By building its own gears Westinghouse gives the geared drive exactly the characteristics necessary to get the highest efficiency possible from the complete unit.

**GEARMOTORS GIVE THE ADVANTAGE OF HIGH SPEED MOTOR EFFICIENCY & POWER FACTOR**

Another advantage for the user is the fact that Westinghouse Gears are made of heat-treated, forged steel, cut by the hobbing process—the most accurate method of gear cutting yet devised. This assures quiet operation and the ability of the reduction gears to transmit the full torque of the motor under load and to withstand the shocks of severe service.

For complete information on how you can cut operating costs for your slow speed drive requirements, write or call Westinghouse Electric & Manufacturing Company, Dept. 7-N, East Pittsburgh, Pa.

J-07180

# Westinghouse

## GEARED DRIVES

# FOR EVERY *Better Light-Better Sight* PROGRAM

## ALZAK
*REG. T. M., ALUMINUM COMPANY OF AMERICA
## ALUMINUM
## REFLECTORS

Reflecting surfaces that meet the requirements of every lighting job; you can get them with Alzak Aluminum Reflectors, with diffuse or specular surfaces, and combinations of the two. There are no limitations on reflector shapes.

Alzak Reflectors give you the most in lighting efficiency. A lasting, high reflectivity is obtained by a special electrolytic treatment of Aluminum sheet. The smooth, oxide coating of glass-like hardness will not chip and doesn't scratch easily. Cleaning is no problem; simply wash with soap and water.

Some Alzak Reflectors are intended for indoor use. Others withstand out-of-door exposure and the corrosive conditions encountered in certain industrial processes. Whatever your use, be certain that you obtain the right Alzak finish for each job.

We do not manufacture reflectors. Manufacturers who are licensed under Aluminum Company of America patents can advise you and supply your needs.

ALCOA ALUMINUM

You can identify a genuine Alzak Reflector by a label affixed to it by the manufacturer. This lists the patents protecting the processes that assure uniform, high quality workmanship. Look for that label when you are buying reflectors.

ALUMINUM COMPANY OF AMERICA
1941 GULF BUILDING • PITTSBURGH, PA.

# "IT'S 9 TO 1 YOU'RE LOSING MONEY NOW"

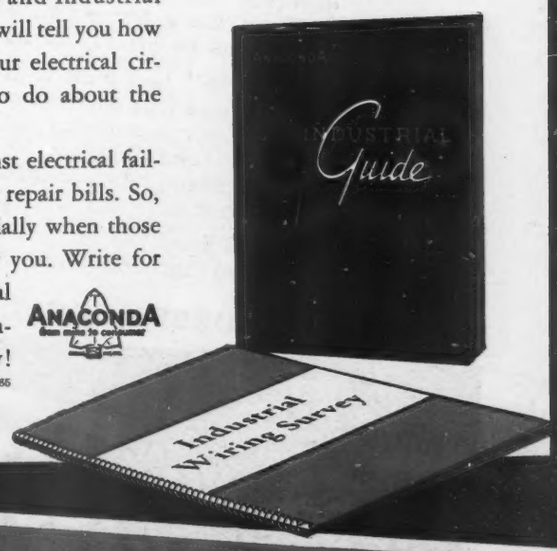
Authorities agree that nine out of ten industrial plants in the country are in need of new wiring. Nine out of ten plants are losing money today through invisible power losses . . . power losses arising from antiquated, worn-out equipment, overloading or failure to provide adequate wiring for new equipment. Is your plant one of them?

Better check up now. Electrical failure... plant breakdown and consequent loss of output is even more expensive. Call in your maintenance man or electrical contractor and go over the problem of your plant's wiring Better yet, ask us to send you our Industrial Wiring Survey and Industrial Wiring Guide. The Survey will tell you how to check step-by-step—your electrical circuits; the Guide—what to do about the conditions you find.

Both are insurance against electrical failure . . . and whopping big repair bills. So, don't take chances...especially when those chances are 9 to 1 against you. Write for *free* copies of the Industrial Wiring Survey and the Industrial Wiring Guide now!

ANACONDA

40365




USE MODERN IMPROVED

## Anaconda Wire & Cable

ANACONDA WIRE & CABLE COMPANY, General Offices: 25 Broadway, New York City; Chicago Office: 20 North Wacker Drive

*A Subsidiary of Anaconda Copper Mining Company. Sales Offices in Principal Cities*

In size . . . the ratio between the two Thermoid Transmission Belts illustrated here is thirty-six to one. In purpose . . . the difference is nearly incredible. The tiny 1" belt used on the steam engine governor has as its greatest feature, perhaps, the extreme flexibility which contributes so greatly to its long life.

The big 36" belt built to tackle such Gargantuan jobs as driving huge rock crushers day in and day out must have the same characteristic of flexibility, plus the strength to withstand unbelievable shock and strain.

Between these two extremes, of course, Thermoid manufactures transmission belts for every degree of speed and load. Each is a complete result of Thermoid's policy of product engineering based upon practical knowledge . . . the use of quality raw materials and the most advanced engineering methods.

You'll find the Thermoid representative in your area well qualified to serve you in the solution of any problem involving Industrial Belting, Hose, Packings or Brake Linings. Specify Thermoid for your next job and let it demonstrate the savings it makes possible.

60 YEARS Thermoid OF PROGRESS

Thermoid INDUSTRIAL RUBBER PRODUCTS

**THERMOID RUBBER, DIVISION OF THERMOID COMPANY, TRENTON, N.J.**

*Standard types of belting made by Thermoid*
Transmission Belting
Conveyor Belting
Multiple V Belts
Grader Belting
Canners' Belting
Bucket Elevator Belting

# Thermoid

*Standard types of hose made by Thermoid:*
Air Hose
Water Hose
Steam Hose
Tank Truck Hose
Gasoline Hose
Suction Hose

BELTING · HOSE · PACKINGS · BRAKE LININGS

# "Specify these NEW COLT MOTOR CONTROLS for efficiency... appearance economy!

**MANUAL STARTERS**
*with Automatic Toggle Mechanism*

**PUSH BUTTON STATIONS**
*Vertical and Horizontal Types*

**TWO-SPEED STARTERS AND REVERSING STARTERS**
*Manual and Magnetic*

**MAGNETIC STARTERS**
*with Three-Point Ball Bearing Action*

*Built To Do a Job for Industry*

**This new line of Colt Motor Controls has been designed for present day precision tools and equipment. You can write them into your specifications with absolute confidence that they will do a he-man's job. Why not send for Bulletins 404, 501 and 504 shown at the right. They will furnish you with detailed data.**

**COLT'S PATENT FIRE ARMS MFG. CO., Electrical Division, Hartford, Conn.**

# COLT MOTOR CONTROLS

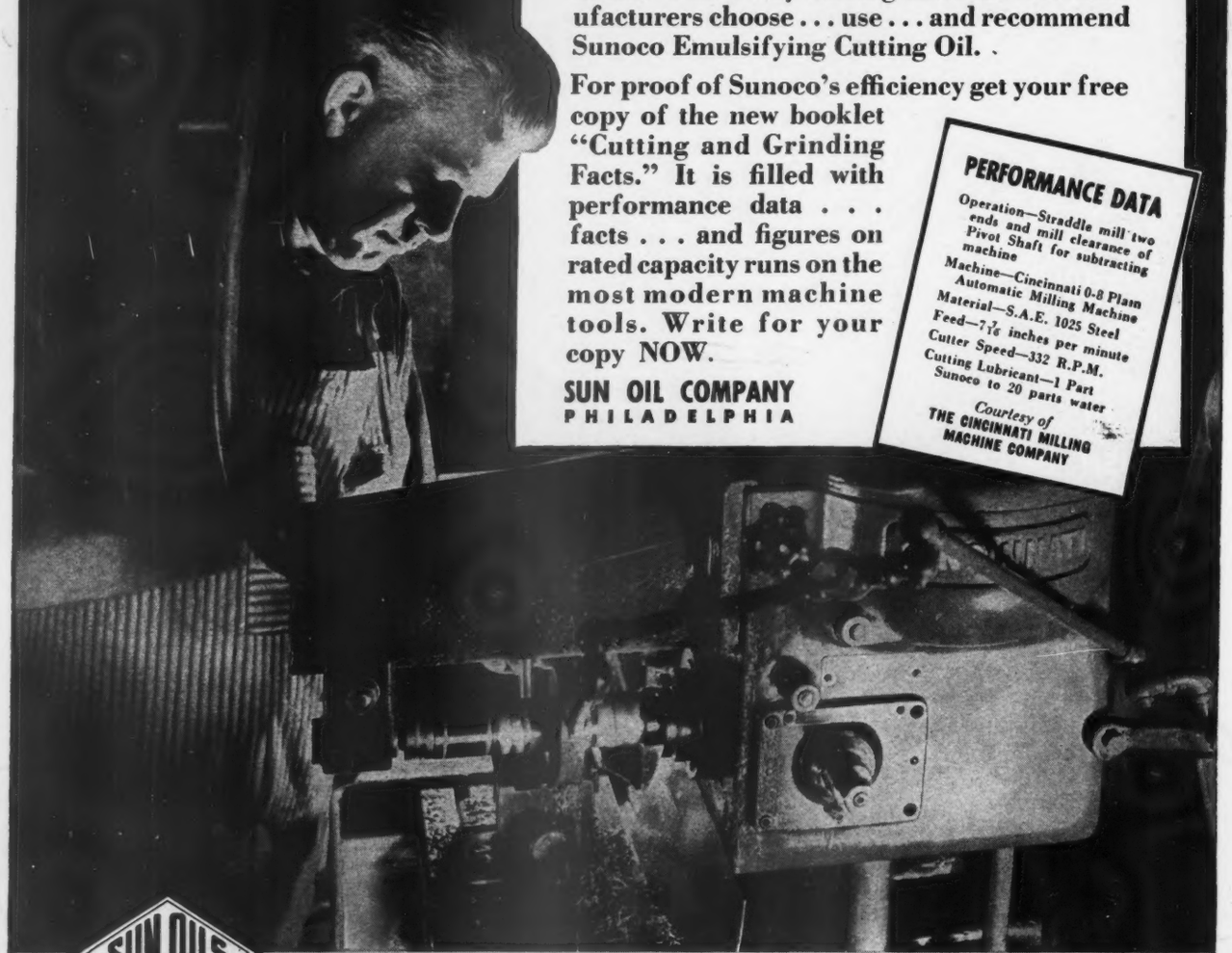
Manual Motor Starters · Manual Reversing Starters · Manual 2-Speed Starters · Magnetic Contactors
Magnetic Motor Starters · Magnetic Reversing Contactors and Starters · Magnetic 2-Speed Starters · Combination Starters · Relays

# Cutter Life Begins at... with SUNOCO EMULSIFYING CUTTING OIL

Now's the time Sunoco Emulsifying Cutting Oil can really do a job for you. Its high heat absorbing and excellent lubricating properties make possible more pieces per cutter grind . . . reduced rejects per machine . . . and the maintenance of accuracy and fine finish. That's why leading machine tool manufacturers choose . . . use . . . and recommend Sunoco Emulsifying Cutting Oil.

For proof of Sunoco's efficiency get your free copy of the new booklet "Cutting and Grinding Facts." It is filled with performance data . . . facts . . . and figures on rated capacity runs on the most modern machine tools. Write for your copy NOW.

**SUN OIL COMPANY**
PHILADELPHIA



**PERFORMANCE DATA**

Operation—Straddle mill two ends and mill clearance of Pivot Shaft for subtracting machine
Machine—Cincinnati 0-8 Plain Automatic Milling Machine
Material—S.A.E. 1025 Steel
Feed—7 1/2 inches per minute
Cutter Speed—332 R.P.M.
Cutting Lubricant—1 Part Sunoco to 20 parts water

*Courtesy of*
THE CINCINNATI MILLING MACHINE COMPANY

SUN OILS

PETROLEUM PRODUCTS FOR ALL INDUSTRIES

# All These and Heaven, Too

ONE definition of the word "heaven" is: "Any place of great comfort". Hence, comparatively speaking at least, a plant which operates year in and year out free from motor failures is "heaven" when it is compared to one which is frequently shut down for motor repairs.

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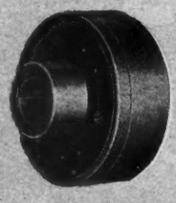

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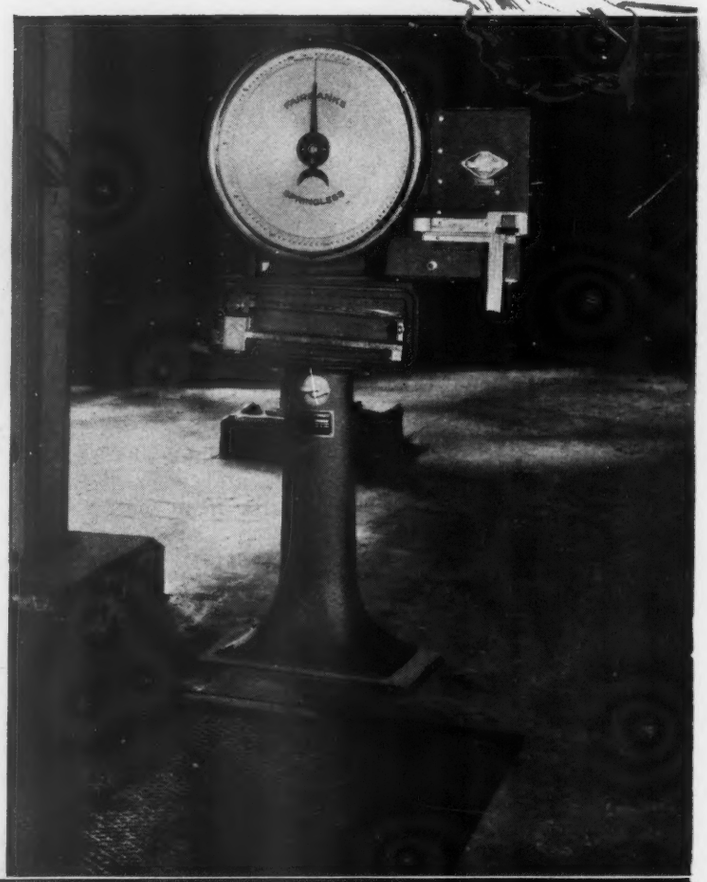

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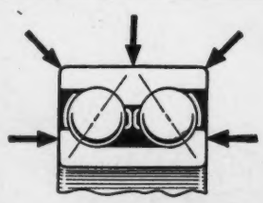

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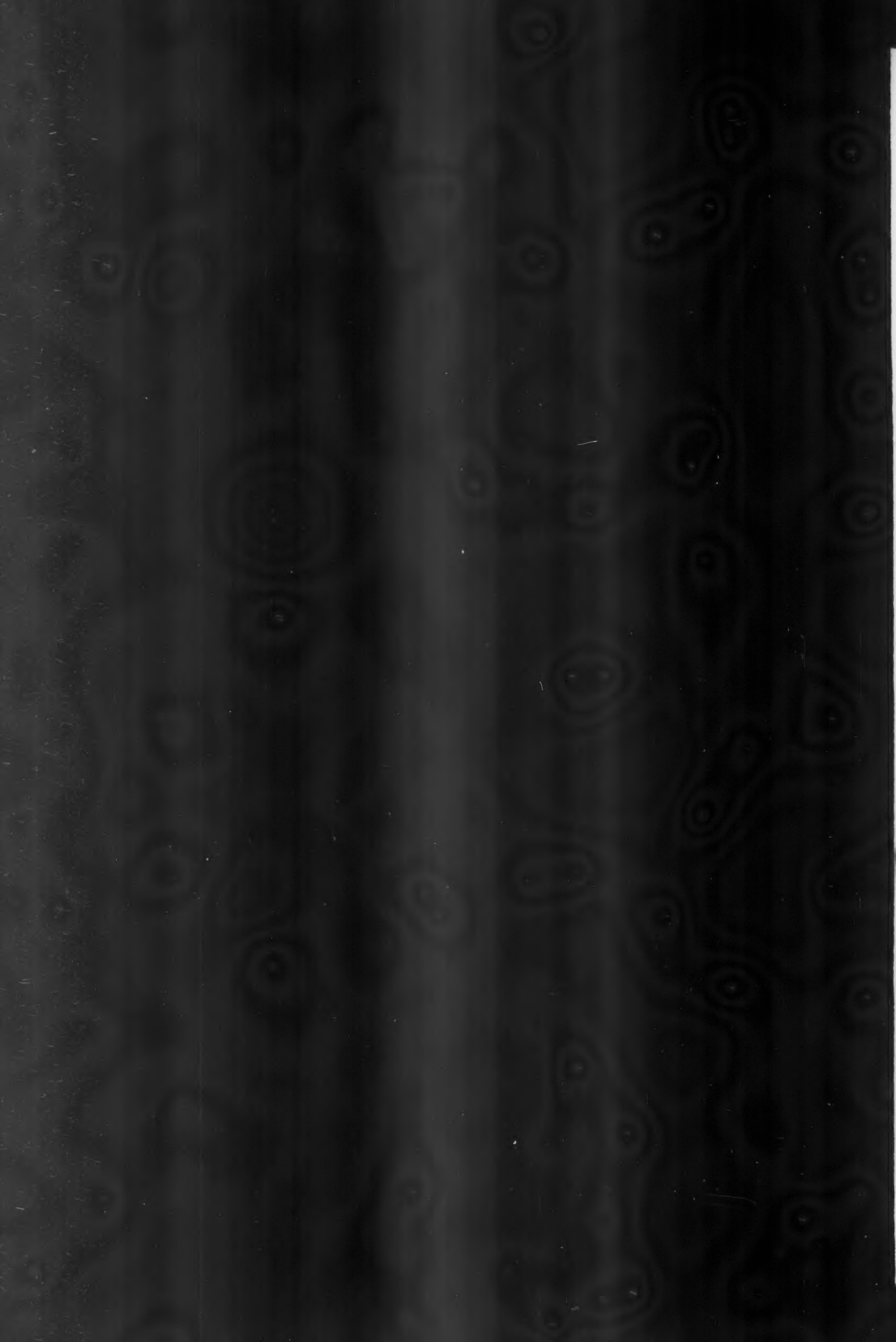


FACTORY
MANAGEMENT and MAINTENANCE
L. C. MORROW, Editor

# American Labor Can Win the War

THE EUROPEAN WAR can be won or lost by American labor. This statement may, at first glance, appear extreme, but I think the following development of the thesis supports the position taken.

Everyone agrees that the war is one of equipment rather than men. Majority opinion holds that American equipment must help England in the interest of America. Only industry can provide the equipment. It cannot be produced without a colossal number of man-hours of work. If these man-hours of work are to be effective, they must be delivered within a relatively short time.

We have a labor government—a fact proved beyond argument by the recent election. This government has gone on record in favor of a 40-hour week. The alternative to stopping after 40 hours is to pay a 50 percent additional labor cost.

American Federation of Labor's "Survey of Business" calls for maintenance of the 40-hour week and also wage increases. Recent pronouncements of CIO leaders are to the same effect.

Despite multiple-shift operation, not enough employees will be available to man our augmented industry. In crucial industries the requirements for personnel are increasing by geometric progression. After all the employables are put to work, still more workers will be needed.

A 40-hour week can be justified only so long as there are considerable numbers of employables still unemployed. After that it will be unjustifiable.

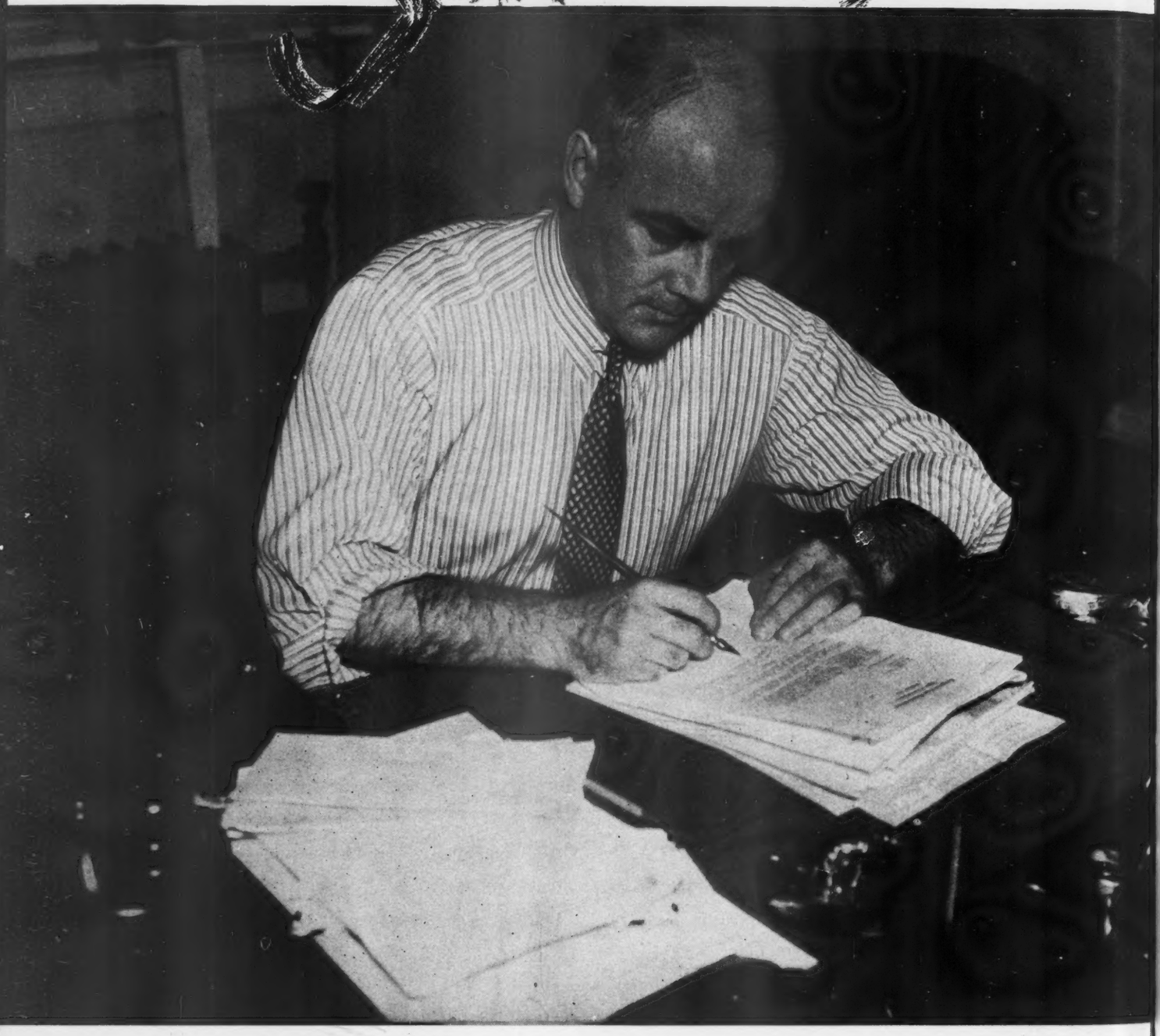
Whether or not increases in wage rates will be justifiable will depend upon prices and profits. If prices go up appreciably, wages will have to go up. If extraordinarily high profits become the order of the day, so will extraordinarily high wages.

Whether or not prices can be held down is problematical. A labor government is most likely to do things that will raise them, and some wage increases may have to come about. But there are ways of holding down profits, and those ways will be taken. For that matter, industry already is committed to expenditures that make extremely unlikely a profit commensurate with the risk.

It is not difficult to conclude from this line of reasoning that American labor holds the key to equipment supremacy and is in position to exercise a controlling influence upon British success.

L. C. Morrow

# Sabotage?



Congressman Thomas hits Department of Justice shilly-shallying:

**"The threat of widespread, crippling sabotage will remain until the federal government agencies, whose duty it should be to correct it, stop coddling the subversive forces in our midst and adopt a hard-hitting policy of law enforcement"**

# You Haven't Seen Anything Yet

**"I make this prediction regarding sabotage to you men who manage America's industrial plants: Be on your guard. You haven't seen anything yet"**

*The Honorable*
**J. PARNELL THOMAS**
*Representative from New Jersey*
*Member, Dies Committee*

TODAY'S ALARMIST may well be tomorrow's prophet. A year ago I was called an alarmist for daring to predict that the furtive figure of the saboteur would soon be stalking in the shadows of American industry.

Yet only the other day, November 12, 1940, three mysterious explosions shook three different industrial plants in Allentown and New Castle, Pa., and Woodbridge, N. J. These blasts, in which 14 lives were snuffed out and scores of persons were injured, occurred *within the space of two hours.* And in Atlanta, at the very same time, the flames were just dying down after an armory fire in which $800,000 worth of government property was destroyed.

"Accidental. No evidence of sabotage," said the investigators as they pussyfooted about in the ruins at Allentown, New Castle, and Woodbridge.

No evidence, indeed? How can there be—when the evidence itself is blown to bits? How long, tell me, are the people of America going to go on accepting "no evidence" as proof that there was no sabotage? The Chief of the Fire Department in Atlanta certainly wasn't fooled by the fact that no saboteurs left their business cards behind them in the armory. He took one look at the wreckage and cried out a warning to all citizens "to awake to the dangers of sabotage." And I'm with him on that.

After all how *can* anyone logically credit the incredible events of November 12 to the long arm of coincidence when we *know* already that the sinister hand of the saboteur is at work in the land? Call me an alarmist, if you will. I do not pretend to be a prophet, but I make this prediction regarding sabotage to you men who manage America's industrial plants:

*"Be on your guard. You haven't seen anything yet!"*

It is of no moment whether your plant is engaged in defense production or not. It is said that neither the United Railway Signal Company at Woodbridge nor the New Castle Plant of the American Cyanamid & Chemical Corporation was working on defense orders. The fact remains that both were *potentially* valuable as defense producers.

Moreover, the undercover wreckers who do the bidding of foreign powers here have a larger aim then the mere destruction of munitions plants. They have their orders to do *anything* to slow down and obstruct the *whole* American industrial economy.

How do we know this? It has been revealed again and again in the testimony taken by our own Committee on Un-American Activities. We know also that these foreign agents and their dupes are in a position to do untold damage. Thousands have wormed their way into key positions in industry, in transportation, in the labor unions, and in our government itself.

These conditions will continue to exist and the threat of widespread, crippling sabotage will remain until the federal government agencies, whose duty it should be to correct it, stop coddling the subversive forces in our midst and adopt a hard-hitting policy of law enforcement.

I refer particularly to the Department of Justice and the National Labor Relations Board. The Justice Department, under the present Attorney General, Robert H. Jackson, has been distinguished chiefly for its "hush-hush" attitude on the whole question of sabotage and for its apparent inability to cooperate with other governmental units bearing on the problem.

By Presidential order this Department's Federal Bureau of Investigation has been charged with primary responsibility for combating sabotage. All other agencies, including the Army and Navy Intelligence services, are supposed to defer to it. As long as this is so, let it take the blame if a new wave of mysterious fires and explosions sweeps industry—which, I firmly believe, it will if Jackson continues his shilly-shallying policies.

As for the NLRB, its very existence and its administration of the Wagner Act, as at present written, provide a shield for potential saboteurs at work in the very heart of the defense industries. Here is what the executives of one major American company, now working on hundreds of millions of dollars' worth of defense contracts, told the Dies Committee in executive session: This company has 600 aliens—some of them known to be connected with dangerous subversive groups—on its payrolls at work in its plants. Yet it cannot make a single move against them lest it be brought before the Labor Board on charges of unfair discrimination. And it has been so intimidated by NLRB in other instances that it is afraid to act.

At the same time, while placing the blame for the deplorable situation that

## ABOUT THE AUTHOR

***The Honorable J. Parnell Thomas, now about to begin his third term in Congress, is already noted for his forceful and direct expressions on public questions. He is a member of the Committee on Un-American Activities (the Dies Committee), the Committee on Military Affairs, and the Committee on Claims in the House of Representatives. He attended the University of Pennsylvania, enlisted in the army at the start of the World War, saw service at the front, and was discharged as a captain. He has been Mayor of Allendale, N. J., and was a prominent member of the N. J. Legislature before going to Congress***

SABOTAGE?
YOU HAVEN'T SEEN ANYTHING YET
(CONTINUED)

KENVIL, N. J. — SEPTEMBER 12, 1940

*Wide World photographs*

"No evidence of sabotage? How can there be—when the evidence is blown to bits?" asks Representative Thomas. He is convinced as the result of personal investigation, that the Hercules Powder Company blast in which 51 persons died was no accident. Kenvil explosion was one of four occurring in powder plants and arsenals of New Jersey alone since the start of the year. "Draw your own conclusions," says he, content to point out that such incidents were not prevalent in America until the new war began

# SABOTAGE

Army code books and other secret papers were endangered when a mysterious blaze damaged one wing of the War Department Building the night of last October 30. Since then the Army has installed a check-up system at the doors to keep strangers from wandering through the War Department at will. During the same month an attempt was made to bomb or burn Moffett Field, Army air base in Sunnyvale, Calif., and a big nitroglycerine bomb was found concealed on the Army transport ship Republic

WASHINGTON — OCTOBER 30, 1940

ATLANTA — NOVEMBER 11, 1940

"How long, tell me, are the people of America going to go on accepting 'no evidence' as proof that there was no sabotage?" asks Mr. Thomas. "The Chief of the Atlanta Fire Department wasn't fooled by the fact that no saboteurs left their cards behind them in the armory (above). He took one look at the wreckage and cried out a warning to all citizens to awake to the dangers of sabotage.' And I'm with him on that." The Atlanta fire, of mysterious origin, caused loss of $800,000 of government property

# OR COINCIDENCE?

"It is of no moment whether your plant is engaged in defense production or not," Mr. Thomas asserts. "The undercover wreckers have their orders to do anything to slow down and obstruct the whole American industrial economy." The blast in this plant of the American Cyanamid & Chemical Corporation was the third to occur in plants of the same company in a single week, although the firm has no defense orders. Mr. Thomas deplores tendency to discount sabotage peril even after "accidents" occur

PITTSBURGH — NOVEMBER 17, 1940

(CONTINUED ON NEXT PAGE)

now exists, I would not exempt industrial management itself which has been deeply at fault, I believe, in its inclination to shrug off the sabotage danger even *after* "accidents" occur.

Too frequently, to my mind, these managements have joined in the game of "let's pretend," giving support to the "no evidence" theory. Why? I do not know. Perhaps they have been instructed to do so by certain authorities. Perhaps they feel a natural human reluctance to admit possible negligence.

### Danger Must Be Faced

No matter. The result, it seems to me, is regrettable in that this attitude tends to put other managements off their guard and thus minimizes the danger at a time when it should be faced—openly, squarely, and publicly.

Here is an example of the complacence which such an attitude may breed. Not long ago the Dies Committee sent investigators to Andover Township, N. J., to study the German-American Bund camp, known as Nordland. The license numbers of incoming automobiles were noted, then compared with the State Motor Vehicle Department records at Trenton. The names of the car-owners, thus obtained, were checked against the Social Security records and their places of employment ascertained. *We found that an amazing number of these men, scores and hundreds, had jobs in key defense industries in the New York area.* We subpoenaed a number of them, questioned them, found they were members of the Bund. Most of them gave weak, unsatisfactory reasons for joining, such as a desire for exercise in the open air or a love of choral singing.

Now it is fairly obvious that membership in the Bund makes an employee worth watching at least. The Dies Committee thought so and accordingly invited all the managements concerned to study its files.

*To date only one company has taken advantage of this offer.*

Here is another case in point. Only two months ago the Dies Committee heard evidential testimony of three instances of outright sabotage in a large Pennsylvania shipyard. An employe told of finding pieces of a cut-up sweater clogging the oil pressure system of a tanker. Hose lines, carrying potentially explosive chemicals, were found to have been slashed by a sharp instrument. Flaws were found in a line of heavy conduit wire—flaws so tiny that they were discovered only accidentally when a workman pricked his finger, yet flaws that could have caused a short circuit and possibly a fire aboard the ship where the wire was used. A loyal employee of the company testified that on his own initiative he had discovered that at least 25 employees of the company were signers of a Communist election petition (all perfectly legal, I admit, so long as the Communist Party retains its legal status) and that known Communists and pro-Nazis had infiltrated the CIO union at the yard and were working together in the distribution of propaganda sheets among the men.

**The Department of Justice, under Attorney General Robert H. Jackson (above), is accused by Congressman Thomas of pursuing a "hush-hush" attitude on sabotage and failing to cooperate with other governmental units. Mr. Thomas predicts a new wave of fires and explosions will sweep industry if Jackson continues "shilly-shallying"**

### He Wasn't Worried

Yet a few days later the responsible chief official of this company issued a statement in which he said he "wasn't worried" about sabotage. Perhaps he is sure that every necessary precaution has been taken in his own plant. If so, he probably has no need to worry. But I can't help thinking of the effect which that statement may have had on other managements and on the public mind.

The World War taught us—at the cost of scores of lives and $150,000,000 in property damage—one vital lesson. When America *awoke* to the danger the sabotage stopped. Management found that its primary protection was knowledge of its own personnel, that its greatest ally was the loyal worker.

Now, you may ask, what is the need for caution? You have read so many soothing statements recently that I am going to list a few outstanding incidents of the past year. Let us say that they are merely thought-provoking. I need go no further than that.

On November 19—Fires aboard new warships at the Camden yards of the New York Shipbuilding Company and the Boston Navy Yards. Damage was slight but one man was badly burned and fourteen were overcome by smoke at Camden.

On November 17—an explosion at the Bridgeville, Pa., works of the American Cyanamid & Chemical Corporation, the third explosion in the plants of this company in a single week. On the same day—a destructive fire at the Pennsylvania Chemical Company, Johnstown, which was making incendiary bombs for the government. Here the owner said frankly, "Sabotage!"

Then on November 12, of course, the Woodbridge, New Castle, and Allentown explosions preceded on November 11 by the Atlanta Armory fire. Also on November 11, the discovery of emery powder in vital parts of four new machines and water glass in the cooling system of a fifth at the Todd Shipyards, Seattle.

On October 30—A fire which endangered Army code books and other secret records at the War Department Building

in Washington, D. C. On October 19—an attempt to bomb or burn a hangar filled with valuable planes at Moffett Field, Army air base at Sunnyvale, Calif. Also in October—discovery of a dangerous bomb on the Army transport ship, Republic, en route from San Francisco to New York.

On September 12—the dreadful Hercules disaster at Kenvil, costing 51 lives—the fourth blast in New Jersey plants and arsenals making explosives since the start of the year. Almost forgotten now are the two blasts, causing six deaths, at the Gibbstown plant of E. I. du Pont de Nemours & Company, one on January 12, the other August 17.

I might remind you also of the mysterious series of machine tool thefts from the warehouses of New York, recalling similar robberies of 1914–18. At Providence, last year, a suspected saboteur was actually arrested and charged with putting emery dust in a gyro mechanism at the naval torpedo station.

Draw your own conclusions. These are merely incidents mentioned at random. I shall content myself by pointing out that such events were *not* prevalent before the outbreak of the war.

The testimony we heard in the earliest days of the Dies Committee opened my eyes to the inroads that communist agents were making in American institutions—schools, colleges, labor unions, governmental agencies. We learned even then that the communists had planted at least one agent—many of them radio operators—on each of 125 American merchant ships and that Moscow-directed agitators were getting a foothold in many industrial plants.

### Sworn Enemies of Our Ideals

At the time, you may recall, the communists were loudly opposed by certain groups which, in one way or another, were already beginning to betray a certain sympathy for the fascist governments of Europe. *Their* insincerity became apparent soon after the conclusion of the Berlin-Moscow pact. For then the American agents of these two former foes began to operate in concert. So today we *know* that all these men—whether they represent the red fascism of Stalinist Russia or the brown communism of Nazi Germany—are the avowed devotees of the same basic ideology and the sworn enemies of our own ideals.

I fear, however, that in recent months, the emphasis of investigation has shifted rather too suddenly away from the communist problem. We shall be making a serious mistake if we concentrate our attention solely on the nazi-fascist combination, vicious as it is. The communists are more numerous, longer established, better entrenched. Moreover they are still more difficult to detect whereas it is comparatively simple to identify a nazi stooge. The latter has no liberal "front" organizations in which to hide. In fact the only protective coloring he can adopt is that of pacifism. I do not mean to condemn every pacifist. But the pacifists do get help from the forces of subversion. Communists have picketed legislators who voted for defense funds. Similarly, a Bund lawyer claims to have originated the slogan, "The Yanks Are Not Coming," which the communists seized upon joyfully.

The Bundists have helped the powerful CIO Maritime Union and thus kept it in a position to tie up and utterly paralyze the nation's merchant marine at any time it chooses. But remember, Bundists or no, the communists are *on top* in the Maritime Union as they are in the West Coast Longshoremen's Union of Harry Bridges, the New York Transport Workers' Union, headed by Michael Quill, and many others. Is it any accident, then, that Curran, Bridges, and Quill should have led the fight at the recent CIO convention against a resolution to bar members of the Communist Party *and* the Bund from CIO membership?

### Helping the Stalinists

By the same token, it was the communists who arrived first and got themselves set in key positions in the government itself. In the Labor Board, especially, they did yeoman service in helping Stalinists labor organizers to get their foothold in certain unions.

In this connection, I must express my great relief and encouragement at the appointment of Dr. Harry Millis as a member of NLRB. This will give Dr. William S. Leiserson the majority support of a definite anti-communist in the Board's top command at a very critical time. Dr. Leiserson and Dr. Millis should be able to accomplish a necessary staff housecleaning *just in time*. In this I am not voicing conclusions that are solely my own. To give you an idea of the seriousness of this situation, as it has been, I shall quote instead from a *socialistic* publication, *The New Leader* of New York, which on September 28, when the appointment of Dr. Millis was still in doubt, warned in headlines: "Communists Plan Tie-up of U. S. War Industries Through Control of National Labor Board."

I cannot feel fully confident of the future, however, until there is a general housecleaning of "reds" and their innocent but helpful stooges in all the government agencies where they have found a footing.

This, of course, is quite apart from and not to be confused with my views concerning the Department of Justice which has been at fault in its flagrant failure to proceed vigorously against known "communazis." The Attorney General has shown a concern for the preservation of civil liberties which is fully justified. But when we balance the civil liberties of a few who might be unjustly suspected against the very lives of helpless workers who may be blown to bits in industrial explosions, we can easily find the answer.

I agree in part with the Chairman of our Committee, Congressman Dies, when he says:

"Sabotage is one of the easiest crimes to commit. With due respect to the Federal Bureau of Investigation—and they are a fine agency—the whole method of approach must be radically changed. These foreign agents must be exposed and once exposed, when the public knows who they are and where they are, their usefulness ends."

**"There is nothing holy about the FBI," says Mr. Thomas, replying to Attorney General Jackson's charge that the Dies Committee is seeking to undermine public confidence in the bureau headed by J. Edgar Hoover (above). Mr. Thomas criticizes a recent article by Hoover designed to allay fear of sabotage. But he urges management to read the FBI booklet, "Suggestions for Protection of Industrial Facilities," available to companies on written request of an executive official**

Mr. Dies agrees with me that there is little doubt that the Hercules explosion at Kenvil was sabotage, although this has been officially discounted. It

so happens that I was in the vicinity of Kenvil at the time of the explosion as was also Robert Barker, a Dies Committee investigator. We were on the scene a few minutes later and, although working independently of each other, came to the conclusion, through conversations with workers in the company's employ and through what we were able to see before the damaged area was closed to visitors, that the blast was no accident. At Kenvil, by the way, the Committee had already learned of the employment of 50 aliens in the Hercules plant.

I feel with Mr. Dies that the FBI cannot possibly be fully effective in the fight against sabotage until there is a change in the "hush-hush" policy of the Attorney General to whom it must report. Director J. Edgar Hoover is doing what he can. He has prepared a plant protection manual which is available on request to top executives of industrial corporations. His investigators stand ready to visit plants, at the request of the management, to study the precautionary set-up, and recommend necessary changes. I strongly urge all managements to take advantage of this service.

## Spotlight on Subversive Groups

But I also maintain that there will be definite limits to what the FBI can do until we are free to single out and remove from danger spots all the potential saboteurs, without waiting to gather criminal evidence against them after their deeds are done and the evidence is obliterated. Moreover, since the FBI has been charged with primary responsibility it should not be hampered by conflicts in the authority and policies of other governmental agencies, such as the Labor Board and the Department of Labor, that have bearing on the problem. It is obvious, therefore, that the Dies Committee serves a worthy —in fact, a vital—purpose in keeping the spotlight on subversive groups and keeping the public aroused to the very real danger that we face.

Attorney General Jackson does not agree, I fear. Practically all the Dies Committee's dealings with his department have been on a one-way basis. Time and again the Committee has made available to him information of the utmost importance. Seldom have we heard whether use was made of these data or whether action was taken. On the other hand, the Committee's few requests for information from the Justice Department have met with polite refusal. On September 5 Mr. Dies requested the FBI file on Dr. Gerhard A. Westrick, the German "trade representative" in whom we had good reason to be interested because of the many unexplained visits he received from industrial workers at his hideaway mansion in Scarsdale, New York. On September 11, Matthew F. Maguire, Special Assistant to the Attorney General, replied in a letter full of such elegancies as "desire to cooperate," "extend all possible aid," and "so long as they do not transcend the limitation of policy that the department has been constrained to adopt in the public interest," but ending in the familiar "feel we cannot accede at this time." Among the reasons given was the danger that further exposure of Westrick's activities (originally disclosed not by any governmental agency but by the New York Herald-Tribune) would "defeat the purposes" of the FBI's so-called secret investigations.

Not in the public interest? And, pray, defeat what purposes? A few days later Westrick was on the high seas bound for Japan and still in possession, I believe, of a great deal of important information. The Dies Committee could unquestionably have detained him with a little help from the Justice Department.

Mr. Jackson now accuses the Dies Committee of seeking to undermine public confidence in the FBI. He implies that the Committee is overly interested in getting publicity. In the course of this he admits that the FBI has discovered that communists started and prolonged the Vultee Aircraft strike in California.

## Nothing Holy About the FBI

To begin with, I don't think there is anything holy about the FBI. All it has to do to retain public confidence is to follow a policy that deserves confidence. Frankly I don't think there is anything to inspire confidence in the signed article which Mr. Hoover contributed to the Hearst press on November 19 in which he warned the public not to be "hysterical" about the sabotage peril and declared calmly that "accidents will happen." (On the same day there were two more shipyard fires.)

It is ironic, to say the least, for anyone speaking in defense of the FBI to accuse any other person or group of an undue desire for publicity. Finally, I don't think for a moment that Mr. Jackson would have admitted the presence of reds in the Vultee strike if he had not been smoked out by the Dies Committee's "White Book."

This article has been written for the primary purpose of putting the spotlight on the sabotage question and urging FACTORY readers not to be lulled into a sense of false security by "hush-hush" tactics. If I have accomplished this much, I am well satisfied. Space does not permit nor do I feel qualified to present a detailed program of plant protection for the reader's guidance. But I repeat, because I believe that it cannot be said too often or emphasized too much, *that the employer's check-up of personnel is the paramount thing.* That is the one big lesson we learned from the World War, and it is the one thing that we must remember above all others today. Every employer should *know* the men who are working for him, know their views, their associations, and their records.

## Free From Hush-Hush

In this the Dies Committee, because of its unique position as a non-bureaucratic agency free of "hush-hush" restraints, can really be of service to industry.

There is material of vast value to management in the files of the Dies Committee. We have the names of thousands of men whom we have reason to suspect because of their connections, past or present, with subversive organizations. Some of these men may even now be employed in positions of trust in your own plant. We have also, out of our long study of the subject, compiled a great deal of information that should be helpful to you in detecting subversive tendencies, however skillfully veiled, as they take form.

These files are available to you. I honestly believe that if every industrial company were to send a man to Washington to study our data, we should be making a long stride forward toward the solution of the sabotage problem.

We, of course, cannot offer you any protection from entanglements with the Labor Board. You may still be unable to discharge an employee who, you know in your heart, would welcome a chance to help Hitler and Stalin by weakening American defense or retarding American assistance to England. But you can, forewarned, keep an eye on him and place him in a position where he is least likely to work any damage.

We cannot at the moment—any more than you can—drastically change the policies of the federal government with respect to sabotage or compel the Department of Justice to adopt a frank, open, vigorous program of aggressive action against potential saboteurs.

But if you will think, talk, and, within the limits of your own position, *act* to protect your own plant and awaken others to the danger, then you will have the satisfaction of knowing that you have done your part to stop sabotage *now.*

*Photographs by Goro*

**Work simplification principles dictate arrangement of workplace. Tools are located where they can be readily grasped by right hand. Bins and hoppers are placed so that assembly parts are easily secured**

# More Production With Less Effort

## BY WORK SIMPLIFICATION

MORE CARS, more clothes, more food, more fun—we the people of America have always wanted more of everything. Today, with the biggest defense program of all times on our hands, we shall still want more of everything—with guns and tanks and planes at the top of the list, and with time of the essence. For industry it is the old, familiar problem of increasing production. Not only must industry find ways to increase the productivity of the workers in its plants. It must also find easier ways of doing the day's work because wartime production often calls for extreme effort on the part of workers, supervisors, and executives. Biggest job is to eliminate waste of time, waste of energy, waste of materials. Those whose task it is to eliminate these wastes find work simplification a most effective tool. FACTORY therefore feels there is no better time than right now to take readers behind the scenes and show them how simple projects are worked out. Photographs on these pages were taken last summer at A. H. Mogensen's Work Simplification Conference, Lake Placid, N. Y. (CONTINUED ON NEXT PAGE)



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**Simplest motion involves use of the fingers only, as in nut-and-bolt assembly. Few operations in industry are as simple as this. When a methods man gets a job down to plain finger motions, he gives three cheers**

MOST HUMAN WORK is done by hand motions. When we study methods of work we therefore look for the elementary motions that are involved. Hand motions, we learn, can be classified five ways, as demonstrated in the photographs. Note that the simplest kind of motion involves use of the fingers only, and that each succeeding type calls for the use of one more part of the body—first the wrist, then the forearm and upper arm, finally the whole body. So, the farther down the list of motions, the longer the time needed, the less the accuracy, and the greater the fatigue. Obviously the goal is to eliminate the more complicated motions and get right down to those that require the least expenditure of time and effort. Reaching beyond the maximum grasp area (marked by the solid arrows), as the subject is doing in the fifth photograph, necessitates a change of posture, involves needless effort. Where possible, all tools, parts, supplies, and machine controls should be located within the normal grasp area (marked by the hatched arrows) and certainly not beyond the area of maximum grasp. These five classes of motions must be understood before the methods man is ready to tackle a specific problem.

# d Easier and Better Ways, Look

Add wrist to fingers to get a motion of the second class. To demonstrate, the subject is using a hand drill as it should be used

# for These Five Motions

Forearm now enters the picture. Add it to wrist and fingers to get a third-class motion. Hammering offers a classic example

4

Add upper arm. This is a motion of the fourth class. It takes fingers, wrist, forearm, and upper arm to use a hacksaw

Body movement added to use of fingers, wrist, forearm, and upper arm makes this fifth class motion most fatiguing of all; subject is measuring a slide fastener which delegate from Talon, Inc., brought to conference as project

5

CONTINUED ON NEXT PAGE

**The Job** **Among projects brought to the Work Simplification Conference was a small iodine applicator made by Johnson & Johnson. Problem was to find better, quicker way to assemble it**

# The Case of the Iodine Applicator

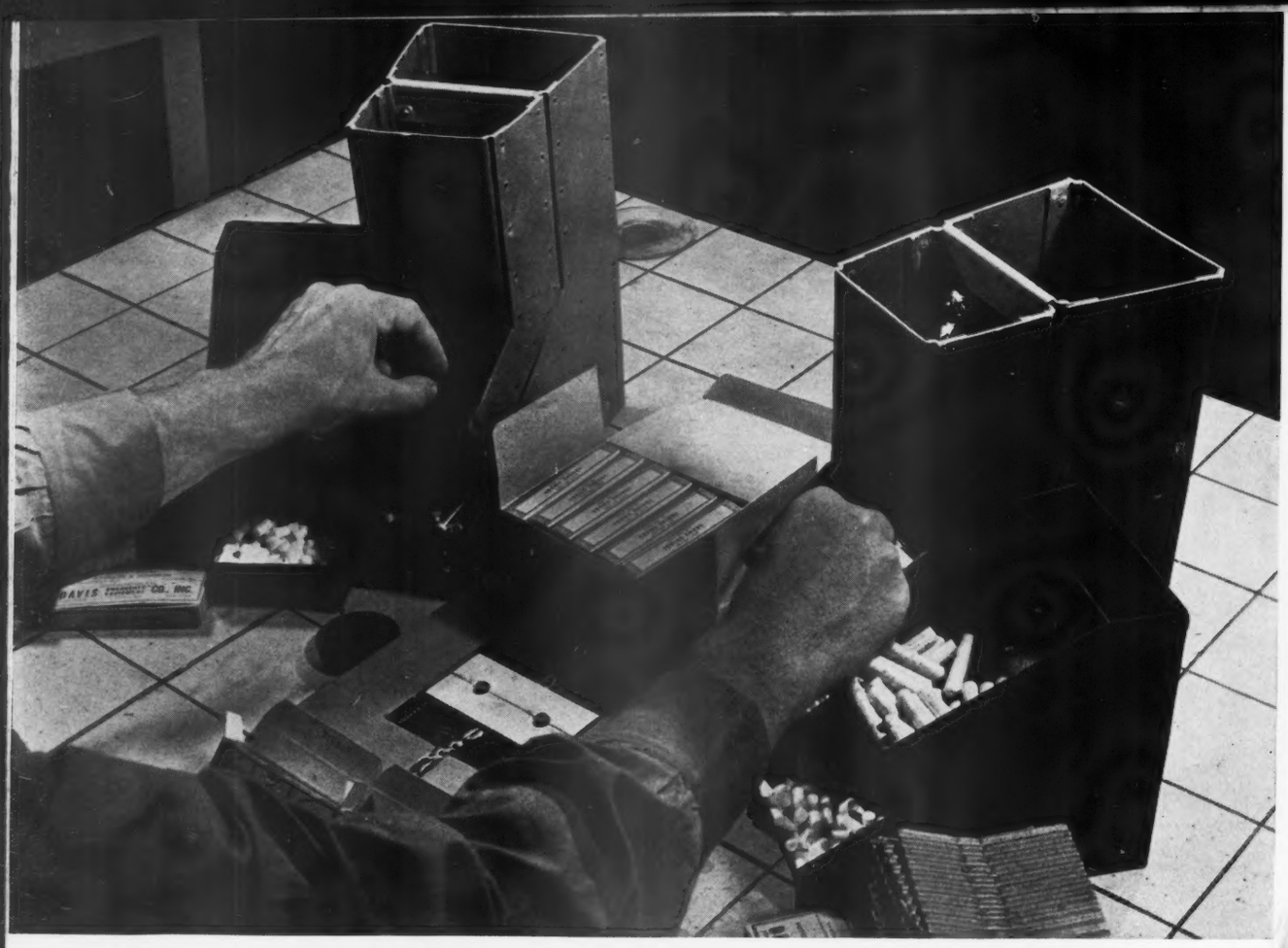
## An exasperating job succumbs to work simplification principles, is changed into an easy, two-at-a-time task that can be done in less time and with less effort

So far we have been dealing in principles. Time now to show how those principles may be applied to a specific task. Take, for example, the little iodine applicator that was brought to the conference as a project by one of the delegates. Note how, in the factory method, the left hand was just about as useful as a vise. It did little but hold. Note also how difficult it was to force the cotton swab into the container. And then see what a difference a simple fixture and a properly set-up workplace can make. In the new method, it is actually possible to assemble two iodine applicators—and better ones, at that—in less time and with less effort than it used to take to assemble one applicator at a time. Why, you ask, is it now easy to insert the cotton swab? It's the funnel-shaped opening in the foot-operated fixture that does the trick.

Work was arranged this way when the operation was performed in the factory—flexible transparent containers at left, ampoules of iodine at center, cotton swabs and protective cases at right

## Old Method

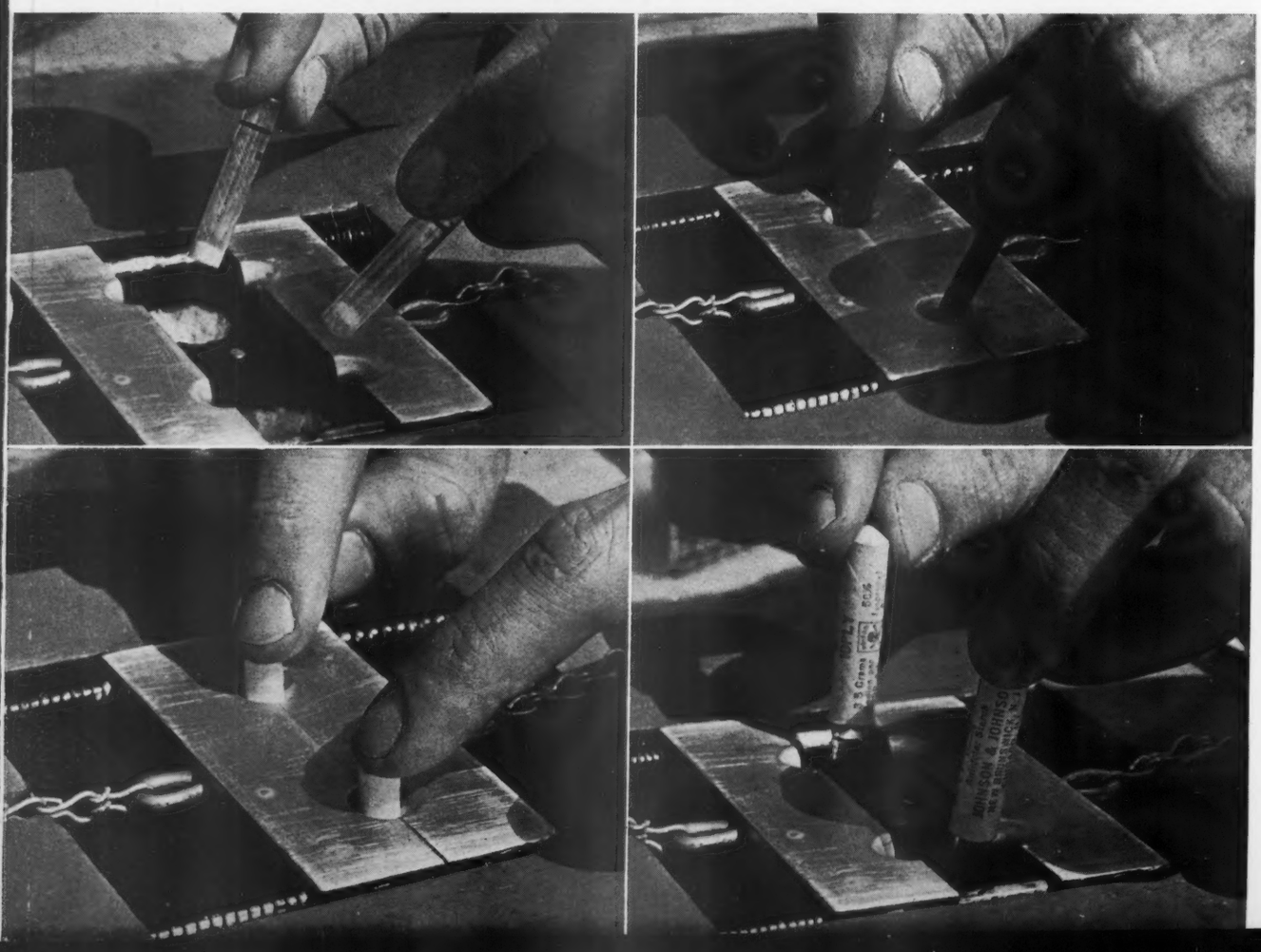
Usual method was to pick up a transparent container in the left hand, insert an ampoule of iodine, then a cotton swab. Finally a case was slipped over the package. Trouble was to get the swab in



## New Method

Same job after the workplace had been motion-economized. Bins are now within normal work area and thus permit easy, two-at-a-time operation, including packing directly into boxes

Close-ups show four steps—positioning containers, inserting ampoules, dropping swabs, slipping covers over units. Note how funnel-shaped openings have simplified task of inserting swabs



# Keeping the Worker Fit

WEBB WALDRON

**The author is a trained reporter—trained to put down on paper a record of what he sees. He is not a technician. In presenting this article, FACTORY seeks to give the impressions of an observer who is not a part of industry, but who steps inside a specific plant to see what is going on in the realm of employee health and safety**

WHEN I CAME HERE, said "Doc" Dobbins, as we strode into the castings department, "they were blasting the castings with sand. We had several cases of silicosis. One day I asked: 'Why not blast those castings with fine steel shot?' It was a new idea in this plant, but they tried it, and it worked. Now we have no dust, and no throat irritations."

We passed on into another department, stopped beside a machine that was cutting up bundles of thick corrugated paper. Dobbins explained how the job was formerly done with a saw that tore through the paper, filling the air with a fine dust—both a throat irritant and an explosion hazard. "I studied the process," said Doc Dobbins. "I wondered why we couldn't use a saw with rippled teeth like a bread knife instead of sharp teeth. We got one made, and look—it cuts through that paper like cheese! No more dust, no more explosion hazard."

### Bad Fumes but No Poisoning

Next claiming my attention is a vat almost full of a dark poisonous-looking liquid. "Bad fumes here," remarks Dobbins. He pulls out his handkerchief and holds it in front of the wide opening of a flue just above the surface of the liquid. The handkerchief is almost dragged from his hand by the suction into the flue. "But a man can't get poisoned," adds Dobbins. "That suction carries it off. In some plants they seem to think that a ventilation hood up at the ceiling of a room full of fumes is going to protect the workers. It doesn't."

This is Servel, Inc., refrigerator makers, Evansville, Ind., and here in the person of Thomas Dobbins, M.D., is the modern industrial doctor at work. Servel is an excellent place to study industrial medicine, because in this plant, covering 47 acres, with 5,000 employees, are found almost all the hazards incident to industry.

Health and safety are closely interlocked, Dobbins explains as we push on. The man in healthy surroundings is likely to be a safer workman, and what good anyhow is it to save fingers and toes if a man's innards are being eaten out by poisonous fumes, gas, dust? Presently I was also to see that safety in the modern plant is related not alone to physical well-being, but also to mental serenity.

"Rules and mechanical devices will go a long way toward providing healthful conditions and safety," the doctor said. "But they won't guarantee it." We stood beside a giant punch press that was cutting out and shaping refrigerator parts. Formerly, Dobbins said, the operator adjusted the pieces with his hands. Fingers and sometimes hands were nipped off when the operator became careless. Now, on Dobbins's suggestion, the operator uses tongs for the larger pieces and a vacuum rubber cup on a stick for the smaller. Result: no more accidents on these presses. "But," said the doctor, "there is nothing absolutely to *prevent* the operator from putting his hand under that press and risking getting it cut off. We have even found cases where a man will go so far as to disconnect the safety device on a machine in order to speed up the output! Such instances are becoming rarer here, because we're building up a *spirit* of health and safety in this plant."

He pointed to the figures chalked on a blackboard: *Department 42—no lost-time accident for 1,191 days.* "Every department has its record chalked up every day," he said. "There's an active rivalry for the best record." Dobbins grinned. "The other day a young lad came in with the end of his finger cut off. 'I'm not worrying about the finger, Doc,' he said. 'What gripes me, I've spoiled the record of my department.'"

When a man or woman comes to work at Servel, the employment department asks, "Have you ever served on a safety committee?" Likely the newcomer says no. "Well," is the answer, "you're now a member of the biggest safety committee you ever heard of—five thousand people."

Here, as in many progressive plants, prizes are offered to employees for suggestions for improving the product, simplifying work, or promoting health and safety. I looked over some safety ideas recently submitted. *Suggestion:* Main furnace fan—oiler must crawl on beams and braces to oil. *Recommendation:* Ladder be erected so he can reach fan without danger of falling. *Suggestion:* Conveyors go up and down steep incline carrying heavy material. If conveyor should break, baskets may fall and injure employees. *Recommendation:* Safety check on conveyor.

### "Doc" Has Eye for Safety

"Often a workman sees a hazard that neither the works manager, nor the foreman, nor I have noticed," said Dobbins.

But I wondered how anything ever escaped Dobbins's eye. As we walked on, he frequently paused, studied a machine, made a note. Once he excused himself, took a man aside, talked to him a few minutes, rejoined me. "Sometimes," he said, "when we see a bad condition that can easily be fixed, as I did there, we merely tell the foreman, instead of reporting it to the head office. That saves the foreman from getting called down for not having seen the thing himself."

Whenever a new machine or process is planned or a new material contemplated, Dobbins knows about it in the blueprint stage. What are the hazards, if any? If Dobbins and his staff consider the new machine, process, or material to be hazardous, possibly some substitute can be devised. If not, adequate safeguards must be made.

In some plants the medical and safety departments are separate. This may work well or not. Safety men and doctor may be jealous of each other—

(*Continued on page 134*)

# Quick Training Gives

**Wanted—skilled men in a hurry. How an aircraft manufacturer trains them. Details of upgrading program that follows recommendations of the Training-Within-Industry Committee of the Defense Commission. How Lockheed is bringing into its factories hundreds of men without prior experience, moving up hundreds of others into skilled jobs**


R. RANDALL IRWIN

*Industrial Relations Director*
*Lockheed Aircraft Corporation, Burbank, Calif.*


INDUSTRY IS TODAY facing a training program as important to the security of the nation as mustering its manpower for service directly in the Army, Navy, and Marine Corps.

The depression years thinned, rather than added to, the ranks of skilled workers and trained production men.

We have just really begun to gear our national defense machine to the production of planes, guns, tanks, ammunition, armaments, and the thousand-and-one things that we need to equip effective combatant units. And the factories that must produce them have, in most cases, exhausted the supply of skilled and trained workers. We have only one alternative, and that is to train the men we need; do it under pressure and with as little dislocation of factory output as possible. In many instances, we are now building factories around production lines and building production crews around skeleton forces.

I believe that the aircraft industry has been facing the training problem longer than most other industries. I know we had the experience of running out of skilled men first. And that is not strange. Aircraft building is comparatively new. In the early experimental period of its development, which continued right up to a few years ago, aircraft construction was a backyard avocation. During that era it could hardly have been glorified by the term "industry," nor could it be justly called a profession or trade.

## "Training Within Industry"

*at Lockheed Aircraft Corporation and Vega Airplane Company*

**1. VESTIBULE TRAINING**—has provided jobs for approximately 1,500 men—men work 8 hours a day under an instructor, and are paid regular wages while learning

**2. VOCATIONAL TRAINING**—in high and trade schools—offers pre-employment training as sheet-metal workers, machinists, welders—4-week courses—top 10 selected for employment each week—by end of first year will have graduated 1,000 to Lockheed jobs

**3. TRADE EXTENSION COURSES**—in a score of subjects closely related to aircraft manufacture—more than 4,500 men enrolled in 135 classes—courses last 5 months—have enabled Lockheed to develop leaders and specialists vital to aircraft production

**4. ENGINEERING TRAINING**—a 1-year course for employees whose educational backgrounds will enable them to qualify for engineering work—about 10 percent of the men in Lockheed and Vega engineering departments have come up through the ranks

**5. TRAINING FOR GRADUATE ENGINEERS**—a 1-year course for those who have majored in mechanical, aeronautical, electrical, chemical, or civil engineering—to give them a production background for their work as draftsmen, designers, engineers

**6. AERONAUTICAL ENGINEERING**—a 16-week course for 120 engineers from other industries and projects, begun in July at California Institute of Technology

**7. APPRENTICE TRAINING**—a 4-year course on which as much as 2 years' credit may be allowed—on-the-job training supplemented by 4 hours' instruction a week in technical related subjects—is helping to overcome the acute shortage of toolmakers

**8. LEADER TRAINING**—through trade extension classes, Lockheed has been able to select outstanding employees, groom them for production leadership

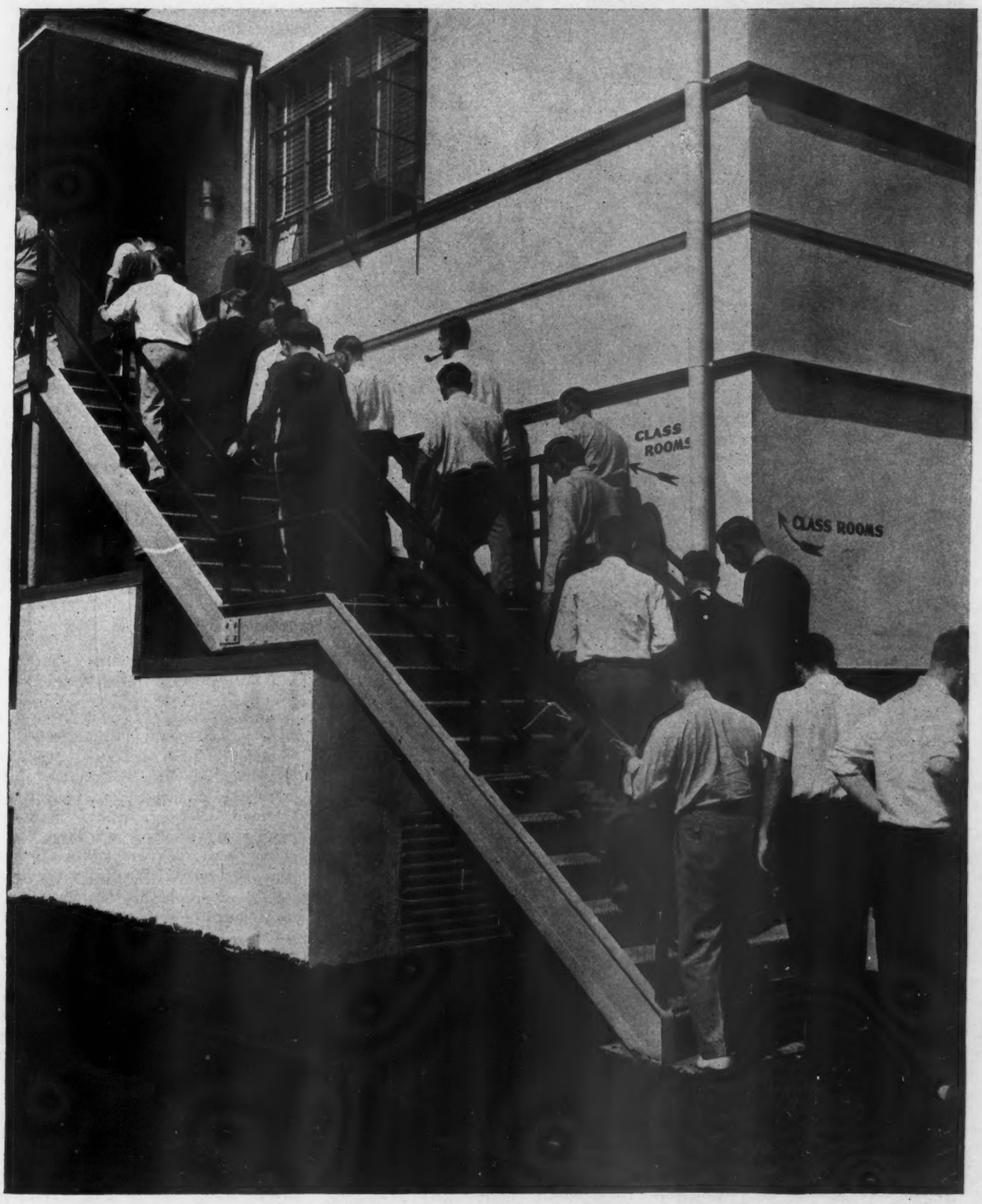
**9. SUPERVISORY TRAINING**—regular classes for foremen, supervisors, and leadmen

### Progress Dates From 1937

Those engaged in the work, for most part, were combination adventurers, promoters, self-made engineers, and all-round mechanics. It was not until the middle '30's that the manufacturing of aircraft emerged as an industry. Our real progress as an industry dates from about 1937.

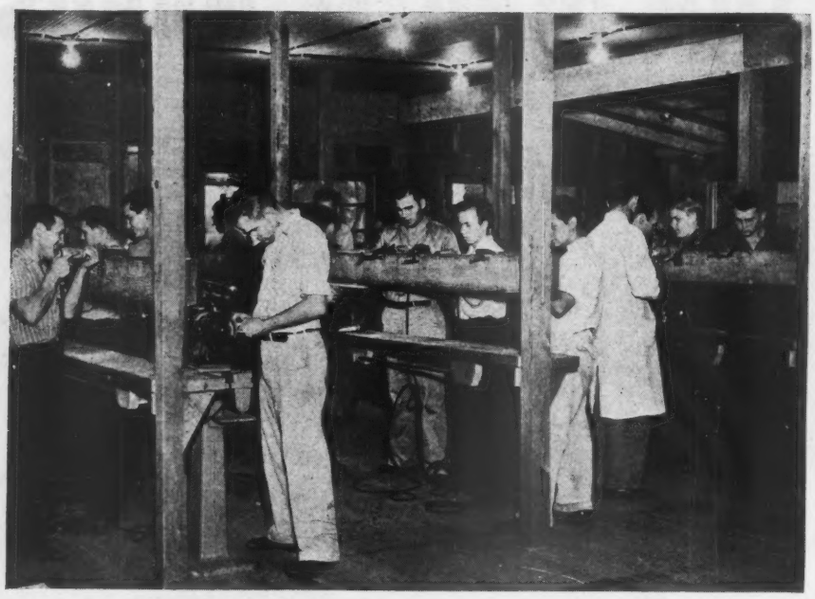
Our first big orders for planes from the Allied governments found us less prepared for mass production of airplanes than we are today. On receipt of those orders in 1938–1939, we had to turn to other industries for many of our skilled men, as the aircraft industry had not had time to build up a reserve of skilled workers of its own. In a surprisingly short time we skimmed the cream of the crop near our own factories and had to go farther and farther afield. The announcement of the United States

# Lockheed the Men It Needs




**Up the stairs to better jobs. In a plant-wide training program to meet future production schedules, classroom work is part of the daily routine for more than one-third of the 15,000 men now employed in the greatly expanded Lockheed and Vega factories**

## BEST TEN EACH WEEK GET LOCKHEED JOBS



Vestibule courses have been supplemented and partly supplanted by pre-employment training in Burbank schools. There are no frills in this classroom at the John Burroughs Evening High School, where training in sheet-metal work (above), riveting (below), and welding is being given on a 24-hour schedule. The first of four 6-hour classes starts at 6 o'clock in the morning. More than 250 students have already graduated to Lockheed and Vega payrolls. One thousand men are expected to be trained during the school year. Riveting instructor is Carl Miner of Lockheed experimental sheet-metal department

Defense Program, however, brought us face to face with the fact that the era of recruiting was past, and that the era of training was at hand.

To get an idea of what the aircraft industry has been through in trying to build up its factory personnel, and what we still face, it might be well to point out that in the summer of 1937 the aircraft factories in Southern California, representing approximately 60 percent of the nation's aircraft production, employed 7,400 persons. Today they employ nearly seven times that number. Lockheed, and its subsidiary, Vega Airplane Company, alone employ 15,000 and are likely to treble their payrolls in another year. Douglas Aircraft Company has just announced an expansion program that will require the hiring of an additional 15,000 persons. Thousands are being added to the payrolls of the other factories. By the early part of 1942 the total number of aircraft workers in Southern California is likely to reach 150,000.

This tremendous increase in personnel has meant bringing into aircraft factories thousands of men without any prior experience in aircraft construction, and in many instances with no prior factory or production experience of any kind. During the next year this number will be greatly increased. Fortunately most of the new men required are in the semi-skilled brackets, but as production is stepped up, the need for men in every capacity will be stepped up with it.

As stated earlier, we in the aircraft industry ran out of skilled and trained men first. For nearly two years we have been confronted with the task of expanding production and training new men as we filled orders from abroad. Now, with the need for United States military aircraft making it necessary to resort to every emergency measure possible to crowd planes faster and faster through the assembly lines, our training problem becomes more complicated because we must train men for their jobs in a shorter time than ever before.

How is this training problem being met?

In answering that question I shall confine my explanation entirely to what is being done at Lockheed and Vega, which is an example of what can be done and is being done elsewhere.

### What Most Men Want

The upgrading of men in these two factories follows in most respects the "Training Within Industry" program now being recommended by the Advisory Commission to the Council of National Defense. It has been in progress at Lockheed on a large scale for the past three years, and to a lesser degree since 1935. We have recognized the fact that jobs are not static, and that inherently most men want to advance in the work they are doing.

Our training program started as a series of lectures in our plant after work. At the outset it was conceived as a means of making better craftsmen out of men who were just beginning to appreciate the fact that aircraft building was a real vocation. By 1937, under the direction of Svend Pedersen, an adopted son from Denmark, who had apprenticed in the Royal Danish shipyards, graduated from the University of Copenhagen, and was a tool-and-die maker in his own right, the Lockheed training program began in earnest. With the cooperation of the

Burbank public schools, and with Lockheed supplying most of the material and instructors needed, 11 trade extension classes were started in various phases of aircraft construction. They ran for a period of 16 weeks. The following year, so great was the interest of the employees, we had to increase the number of classes to 21 and broaden our training within the plant.

During the fall of 1939 and spring of 1940, 2,000 Lockheed employees were graduated from 50 trade extension classes. Of that number, many had been attending trade extension classes since 1937. Fifteen hundred men graduated from a 10-week summer course, concluded in August of this year, and at the present time more than 4,500 employees are enrolled in 135 trade extension classes being held in Burbank schools and in the Lockheed factory. The courses are 5 months long. Classes are being held twice a week, both day and night, to accommodate men on various shifts. Homework is also provided for those who have the time and the capacity for it.

### Classes Night and Day

Special classrooms have been included in the new Lockheed personnel building, completed within the past 60 days. They are used primarily for lectures and drafting. Classes, ranging in size from 6 to 200, file in and out of these rooms throughout the day and night.

Along with the trade extension courses, on-the-job training and supervision of men selected for upgrading are in progress in every department of the Lockheed and Vega plants. And, as said before, this is being done with one eye on the production line and the other on our personnel needs three months to a year hence.

Some of the grading-up training of employees has been accomplished through short "vestibule" courses designed to prepare men for special assignments for which they have shown particular aptitude. The men work 8 hours a day under an instructor and are paid their regular salaries while training. At the close of the training period they are transferred to the jobs for which they are being prepared. Approximately 1,500 men have been trained in these "vestibule" courses.

To meet a growing need for tool designers and planners, not available on the outside, Lockheed, the middle of November, started two 8-hours-a-day classes in tool planning and designing to be held in the factory. Approximately 60 men were selected from Lockheed and Vega, most of whom had previously taken production and design work in trade extension classes. During the period of intensive study, which will continue for a period of 10 weeks, the men will be paid the same rate they have been receiving on the jobs from which they were taken.

Lockheed also started a special course of instruction about mid-November to develop several hundred additional inspectors for the plant's 99 different departments. Two hundred and forty men, selected from 600 applicants, have been enrolled in the first 10 classes which will run for a period of 10 weeks or more. Classes are being held daily between 1:15 and 6:15 p. m., in order to permit night-shift men to complete their studies before going to work and day men to go directly off the job.

The vocational training program, in-

## TEMPLATE MAKERS IN TEN WEEKS' TIME

**Trade extension courses are upgrading sweepers to junior molders, carpenter learners to detail draftsmen, riveters to junior template makers. As production steps up, one of Lockheed's greatest needs will be for template makers. Trainees must be well versed in geometry, trigonometry, mechanical drawing, blueprint reading. V. E. Boyer, left, and C. A. Ling, getting help from J. K. Highley, instructor and chief loft engineer, are typical of the young men taking the course. By doing extra homework they will complete the 18-week course in 10 weeks. Below, Boyer starts on the job under Leadman R. L. Carr**

## RIVETERS BY DAY, ENGINEERS IN THE MAKING AT NIGHT

**During the day these men work as riveters, template makers, file clerks, or on any one of a score of other jobs. At night, twice a week for one year, they are engineers. From these classes in the past three years have come approximately 10 percent of the men in the engineering departments. Right, a group of night school engineers are drawing up plans for model plane conceived by class members. This course has earned the reputation of being one of the toughest given in the Lockheed training program**

augurated on a full-time basis in high schools and trade schools in the past few months, through the aid of federal and state funds, has relieved us of some of the vestibule training we formerly found necessary. This is mostly in the nature of pre-employment training and supplements the trade extension courses. At the present time it is being done on an emergency basis and under pressure.

In the Burbank schools, classes for sheet-metal workers, machinists, and welders are being held night and day. In one school, and in a building that was to have been torn down, sheet-metal instruction is being given 24 hours a day. Classes of 60 each change every 6 hours, starting at 6 o'clock in the morning. Registration is restricted to young men who have first passed the Lockheed aptitude, temperament, and physical tests. The course runs for 4 weeks. However, some students are able

## AERONAUTICAL ENGINEERS TURNED OUT IN SIXTEEN WEEKS

**Recruited from other industries and projects, 120 graduate engineers take intensive 16-week course to bridge gap between their former jobs and aeronautical engineering. First eight weeks were spent in Caltech classrooms. Training is being completed in plant**

Apprentice Charles E. Alley operates an engine lathe as part of his training under the watchful eye of Machinist William Hill

Apprentice Philip R. Herrington (left) gets expert instruction from Toolmaker F. C. Rosinow in the construction of a tool jig

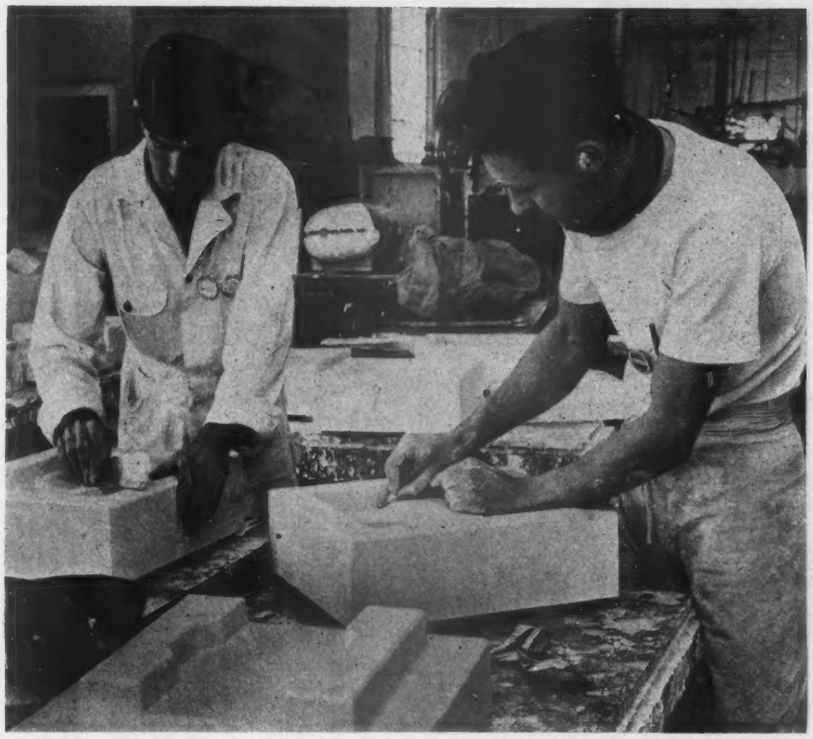
to finish in less time; as a result the top 10 are selected for employment each week, regardless of how long they have been in training. Several hundred have already been employed by Lockheed and Vega, and the school only opened July 29. It is estimated that by the end of the school year 1,000 of these students will have graduated to jobs with Lockheed and Vega.

In the past we looked to private schools for trainees similar to those being supplied through the vocational program. Frequently the company has paid the entire cost of training students whose applications for employment have been accepted pending satisfactory completion of the course. We are still looking to these private schools for some men, and may be compelled again to draw on them heavily in the future.

### Tests Help Pick the Men

Lockheed and Vega adhere to a policy of not employing untrained men. We require the men to be able satisfactorily to perform the elementary phases of the work to which they are to be assigned before they are taken on the job.

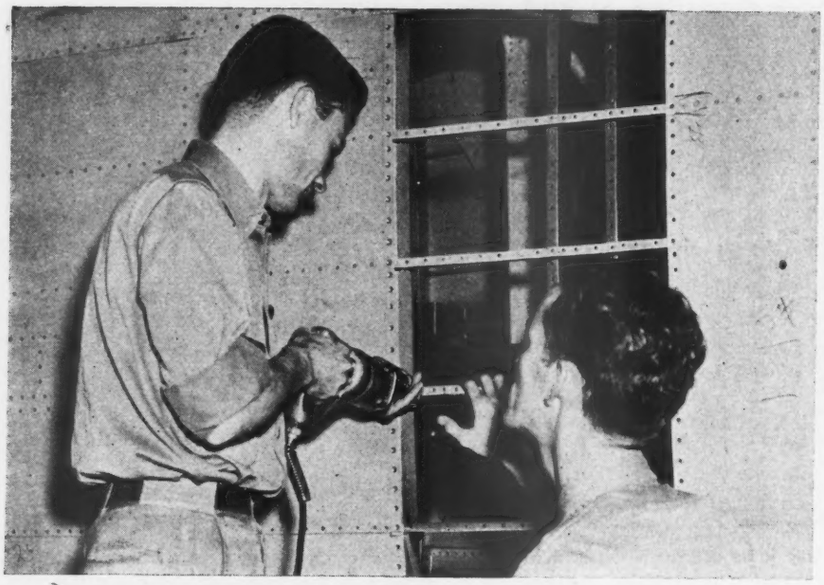
Through aptitude and temperament tests we are able, to a large extent, to determine in advance whether a man will be capable of doing the work to which he will be assigned. Further, each employee is permitted to express a preference for the type of work he would like to do, and although at the outset he may be given a different assignment, he is usually permitted later to transfer when an opening occurs. Where he lacks experience for the job, he is encouraged to take trade extension courses and other training to enable him to step into his chosen line of work. By reason of this procedure we have gained, in most instances, the full and enthusiastic cooperation of the individual, and believe that it has enhanced the success of our training program.



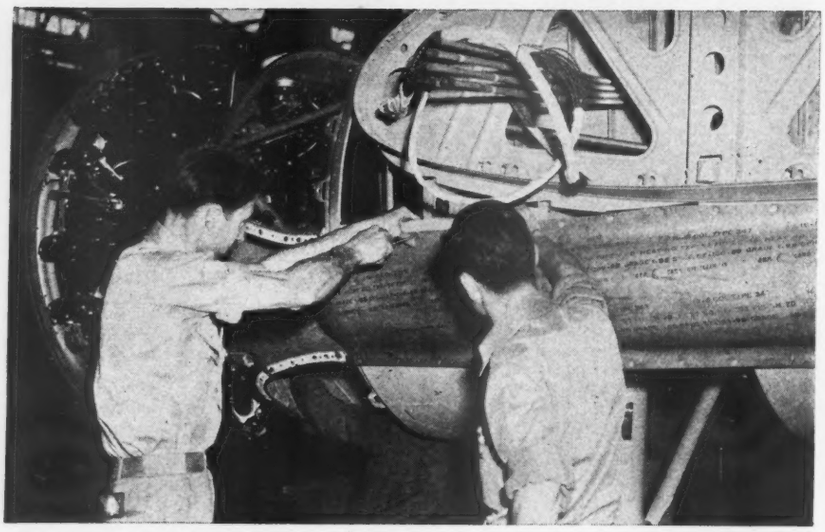
Apprentice Stanley R. Roddick (left) makes the plaster pattern for a drop hammer die under the helpful guidance of Charles Hummel, one of Lockheed plaster pattern makers

An idea of the scope of the training being carried on through the trade extension courses can be obtained from a partial list of the subjects being taught: Airplane Mechanics, Blueprint Reading and Shop Drafting, Drafting (Aircraft Sheet Metal), Drafting (Aircraft Casting and Forging), Aircraft Advanced Drafting (Descriptive Geometry), Industrial Engineering, Lofting I and II, Machine Shop, Materials and

## ARTLIP IS GROOMED FOR LEADERSHIP



**Every department has its leadmen. Their training is a continuous process at Lockheed and Vega plants. In final assembly, R. M. Artlip, five years with the company, is being groomed for leadership under the direction of W. W. White, assistant supervisor. He is here preparing to put a strip of metal "skin" on the nose of a Lockheed Hudson bomber**



**Artlip, nearing rank of leadman, shows "Learner" Merrill how to install exhaust shroud**

Processes, Pattern Making, Aircraft Production Engineering I and II, Aircraft Sheet Metal, Stress Analysis—Mechanics, Stress Analysis—Strength of Materials, Elementary Stress Analysis, Advanced Stress Analysis, Template Development, Tool and Die Making, Tool Design, Aircraft Trade Mathematics—Shop, Aircraft Trade Mathematics — Technical, Aluminum Welding, Aircraft Steel Welding.

Considering that the trade extension courses are voluntary, the interest shown in them by the men in the plant is indicative of three things:

1. A desire on the part of the individual to improve his skill and his knowledge in order to make himself eligible for advancement.

2. A wholesome attitude of the employees toward their jobs and an appreciation of the fact that they must merit their advancement, which is quite a contrast to the belief that the individual is entitled to what he can get, whether he earns it or not.

3. The willingness of the employees to do their part to make the defense program a success. Every man taking the trade extension courses is fully aware of the fact that the increasing of aircraft production for national defense is dependent on the improvement of his skill and his ability to help train others.

The work of each man in the trade extension classes is carefully watched and graded, and a record kept in the Education and Employment Departments. When requisitions are made for men in various job classifications, these files are consulted. A typical list of transfers gives an idea of the upgrading being accomplished.

| *From* | *To* |
|---|---|
| Sweeper | Junior Molder |
| Carpenter Learner | Detail Draftsman |
| Junior Spray Painter | Junior Welder |
| Janitor | Metal Fitter |
| Junior Skin Fitter | Junior Template Maker |
| Senior Template Maker | Tool Inspector |
| Toolmaker | Tool Planner |

The trade extension courses, together with other training given within the plant, have enabled us to develop leadmen quickly and advance thousands of others into key positions and positions of greater responsibility. Through this program we have been able to develop better supervisors, leadmen, metal workers, machinists, template and pattern makers, and scores of specialists vital to our production. This training has given us engineers from comparatively inexperienced but excellent material. It is estimated that approximately 10 percent of the men in the Lockheed and Vega engineering departments have come up through the ranks.

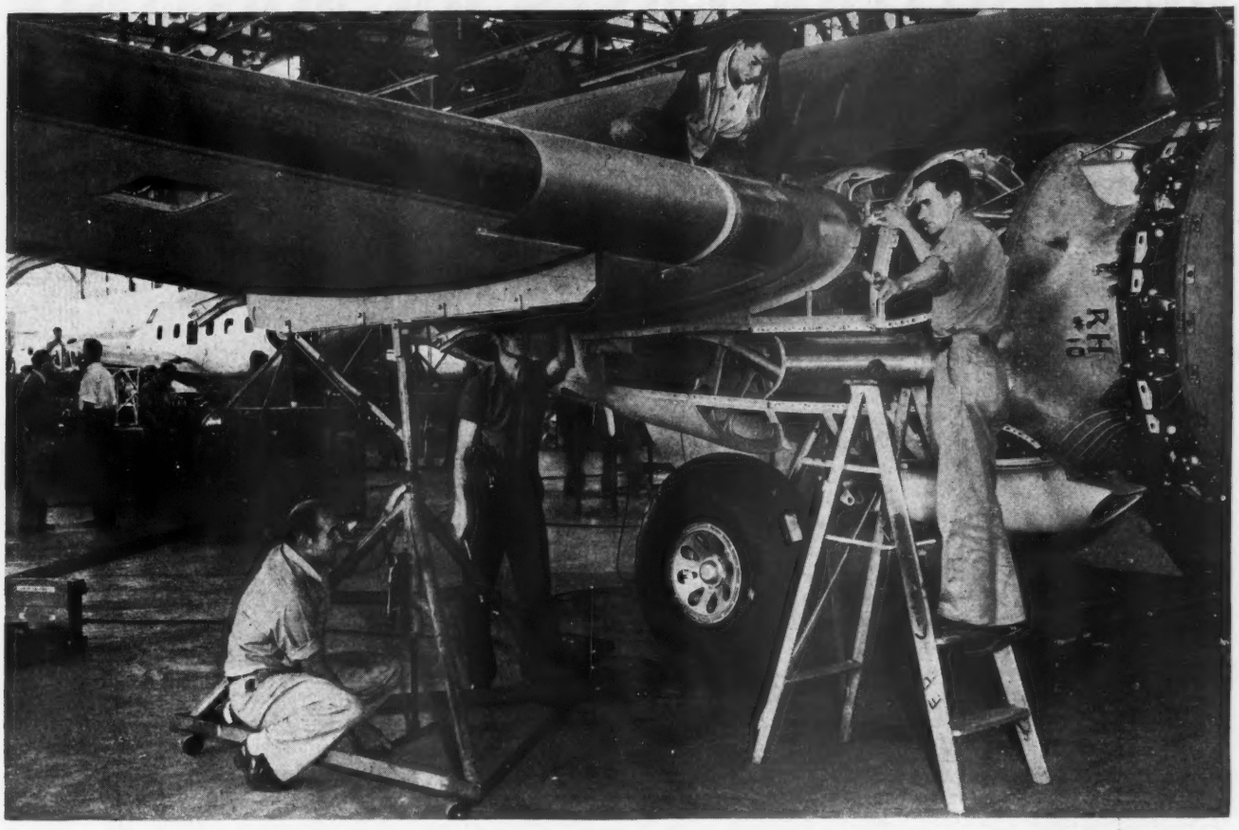
### Engineers in the Making

The training of engineers through the trade extension courses is a slower process than for most other positions. The current classes run for a period of one year, instead of the usual 18 weeks. The engineering trainees include riveters, sheet-metal workers, blueprint filers, clerks, template makers, etc., whose scholastic backgrounds enable them to qualify for engineering work.

At the outset, the prospective engineers are drilled in the elementary phases of drafting and blueprint reading, and are given simple airplane parts to work on. As the class progresses, it is given as a project the designing and engineering of a new model plane. Project engineer, design engineer, and supervisor are selected from among the members of the class, and from then on the class functions as an engineering department. Each man is held responsible for working out the engineering details of a specific part of the plane.

As our plant production steps up, one of our greatest needs will be for

## TODAY, AFTER MONTHS OF GROOMING, IT'S "LEADMAN" ARTLIP



**Artlip is one of scores of men with leadership possibilities uncovered by the training and upgrading program in Lockheed and Vega plants. It is Leadman Artlip now as he supervises (from ladder) the installation of a wing on a Lockheed Hudson bomber**

men in the Template Department. A good template man must have a thorough knowledge of what can be done with sheet metal, and be a combination draftsman and engineer. For the most part, only men who have completed junior college or graduated from a trade school with suitable credits in mathematics and drafting are selected for the elementary template training classes. To go very far in template making, it is necessary for the trainee to be well versed in geometry, trigonometry, drafting, and blueprint reading.

Today, because of the need for men in the Template Department, trainees are being graduated as rapidly as possible from the template trade extension classes. Some of the men, whose previous schooling and aptitude enable them to grasp the work quickly, are completing the 18-week courses in 10 weeks, with the aid of a liberal amount of homework. They are being given beginners' jobs in the department. Their training, however, does not stop with their assignment to the Template Department. They are encouraged to take more advanced template courses. With the aid of this training and supervision by leadmen on the job, from simple layout work they are able to advance to angle templates in 4 to 5 months, and in a similar length of time to form press templates. Within 18 months, or less, many are qualified to do lofting.

In keeping up with the ever-increasing demands for greater aircraft production, no group of employees has been overlooked from the standpoint of training. Among other things, special courses are being given to supervisors and foremen to keep them abreast of new developments, and to make them more efficient leaders. Men who have shown special aptitude and ability to step into supervisory positions are trained for advancement.

### All Types of Engineers

Engineering graduates who have majored in mechanical, aeronautical, electrical, chemical, or civil engineering are being given 1-year training in various departments of the factory to give them a production background for their future work as draftsmen, designers, and engineers. Lecture courses for aeronautical engineers are also being given in the plant after hours.

One hundred and twenty topflight engineers, taken from other industries and engineering projects throughout the country, have just completed at Lockheed a streamlined 16-week aeronautical course begun in July at California Institute of Technology.

The training costs, plus transportation, were borne by Lockheed. The men also received a salary of $200 a month for the duration of the course. This special training program was tried because of the acute shortage of aeronautical engineers. Started as an experiment, it proved that in an emergency men experienced and qualified in other fields of engineering can, in a comparatively short time, be adapted to aeronautical engineering. These men have all been transferred to the Lockheed and Vega engineering departments and are now being paid according to the positions to which they have been assigned.

Last year Lockheed inaugurated an apprentice training program in conjunction with the International Association of Machinists and the Burbank schools. This is already helping partially to overcome the shortage of tool-and-die makers, jig-and-fixture builders, and pattern makers.

As far as I know, this is the first federal- and state-approved apprentice

(*Continued on page 140*)

# Controlling Costs on Multiple

**Not a simple matter, to be sure, but this incentive plan does it by basing set-up men's and supervisors' bonuses on machine efficiency, operators' on their own efficiency**


**E. A. CARPENTER**

*Industrial Engineer, Perfection Gear Company, Harvey, Ill.*

*Mr. Carpenter was born in Chicago 28 years ago. For the past 15 years he has been obtaining practical and theoretical experience by working days and attending evening schools. He earned his technical high school diploma that way, and for the last six years he has attended evening classes in industrial engineering. After leaving grammar school he started to work for Western Union, later worked for the Chicago Transformer Company in capacity of fabricating and assembly supervisor, for the International Harvester Company, Tractor Division, as an inspector. For the past two years he has been in his present job where he is responsible for supervising all of the company's industrial engineering activities*

CONTROLLING COST and efficiency of multiple production machine groups is an important problem in many shops, especially when the machine cycle times differ and the jobs in the machines vary so from day to day that no set routine can be established.

It is simple enough to say that a man should operate a fixed number of machines, the practice in many shops regardless of the cycle times involved. But perhaps not enogh thought is given to whether the maximum man efficiency is obtained without sacrificing machine efficiency. Analysis has revealed that in a great many cases prime labor can be reduced approximately 35 percent, while maintaining efficient machine control. Analysis also shows that jobs that are believed to be showing a profit should truly show a loss, and this loss could be converted into a profit if the proper control were established. Losses should be charged where they belong.

## Man and Machine Efficiency

Man efficiency is maximum only when it embraces the proper motivation, habituation, aptitude, and no man-idle time.

Machine efficiency is maximum when the machine is operating continuously and efficiently with no loss due to machine waiting time.

It is easily understood that the greatest machine efficiency can be attained by having one man operate one machine, regardless of man-idle time; but man-idle time, like machine-idle time, is regarded as a bad investment. Every multiple machine group having a number of machines producing parts in different cycle times has an economical grouping; that is, a grouping whereby the manufacturer is obtaining both the most economical man and machine efficiency, and is therefore producing at minimum cost.

An incentive system, in which the set-up man's or supervisor's bonus is determined by the machine efficiency and the operator's bonus is determined by his man efficiency, furnishes the most satisfactory method of obtaining full benefit of this control.

A synthetic standard is first compiled from time studies, to determine the basic, allowed down time (elements of work performed while the machine is not operating), running time (elements of work performed during automatic machine time), and automatic machine time. A production study is then made to determine the unavoidable machine operating delays.

When an operator is tending a battery of automatic machines having different machine times, there are delays in his tending a machine due to his working on another machine when the first one stops. This is more or less outside the operator's control; hence, allowances are necessary if the true, obtainable possibilities are to be shown. A properly constructed graph will indicate the allowances to be added to the basic cycle time of any particular operation performed as one of a group of multiple machine operations.

The ratio shown on the graph, Figure 1, partially reflects the number of machines an operator should be able to tend if all jobs were of the same man and machine time. The automatic machine time and attendance time of any given job are to be used for calculating the ratio. This ratio and the automatic machine time are used in determining the allowance.

Primarily, the smaller the ratio and the shorter the machine time, the fewer machines an operator can effectively operate to full capacity. For a given ratio at different machine times, the longer machine time will have a lower factor, due to the fewer times during the day when possibility of waiting delays will occur. A partial logarithmic scale is found to suit the variable condition most closely.

In preparing the graph, the results of several production studies were analyzed. It was discovered that the percentage of waiting time decreased as the machine times increased, also when the ratio of man attendance time to machine time increased. The graph in Figure 1 was selected because it dealt with these functions simultaneously.

A preliminary graph showed the trend for jobs having same ratios but increasing machine times, also jobs having same machine times but increasing ratios. Further analysis revealed that the graph graduations for both machine times and ratios were approximately the same. The percent values for corrected machine waiting time, derived from production studies, were plotted in their respective locations on the angular lines of the graph. These values were then averaged as to their proper location. The method of averaging is similar to that of curve smoothing. Upon completion of the analysis, it was discovered

# Machine Operations

that a logarithmic scale laid out as shown in Figure 1 suited conditions most favorably.

From the graph a tabular chart may be derived to simplify rate setting. A similar analysis is made to determine the man waiting allowance. This allowance, when added to the basic man time, will compensate for the man-idle time encountered when the machines are all operating.

A comparative analysis of these two graphs will reveal the most economical grouping. The production studies will also reveal the necessary contingency factors to be added to the basic cycle and man time. The contingency factor embraces allowances for oiling and cleaning machines, which are applied to the man time, and tool changes and adjustments by the set-up man, which are applied to the cycle time.

When the above information is available, a standard allowed man and cycle time for any given job can be determined, and a ratio of these figures can be determined by dividing the man time by the cycle time. This ratio is called the "factor" and reveals what percentage of the standard number of machines a man is operating. Jobs having different man and machine times will have different factors, providing the ratios are not the same. Adding the factors of the jobs in a given multiple machine battery will reveal the percentage of the standard number of machines a man is operating.

### *Example A*

| *Job No.* | *Man Time* | *Cycle Time* | *Factor* |
|---|---|---|---|
| 1 | 1.00 min. | 5.00 min. | .200 |
| 2 | 1.25 min. | 2.50 min. | .500 |
| 3 | 1.50 min. | 15.00 min. | .100 |
| 4 | 0.75 min. | 3.00 min. | .250 |
| | | | 1.05 or 105% |

The above example illustrates four jobs having different man and machine times operated as a battery. By totaling the factors we see that the man is operating 105 percent of the standard number of machines. If the machines are operated at 100 percent machine efficiency, the man's efficiency becomes 105 percent. With an incentive the man will attempt to better the man-allowed time and concentrate on proper cycling, thereby increasing the machine efficiency, which ultimately increases his own efficiency.

It can also be seen that if job No. 4 runs out, and there are no other jobs available, the man will be operating only 80 percent of the standard number of machines; consequently, if he operates the first three machines at 100 percent machine efficiency, his man efficiency is only 80 percent, and without an allowance there would be no incentive to keep these machines operating to maximum capacity. To compensate for this, an allowance table called "Idle-Man-Time Allowance for Multiple Machine Batteries" should be worked up whereby the man will be earning (in the preceding example) 80 percent of the

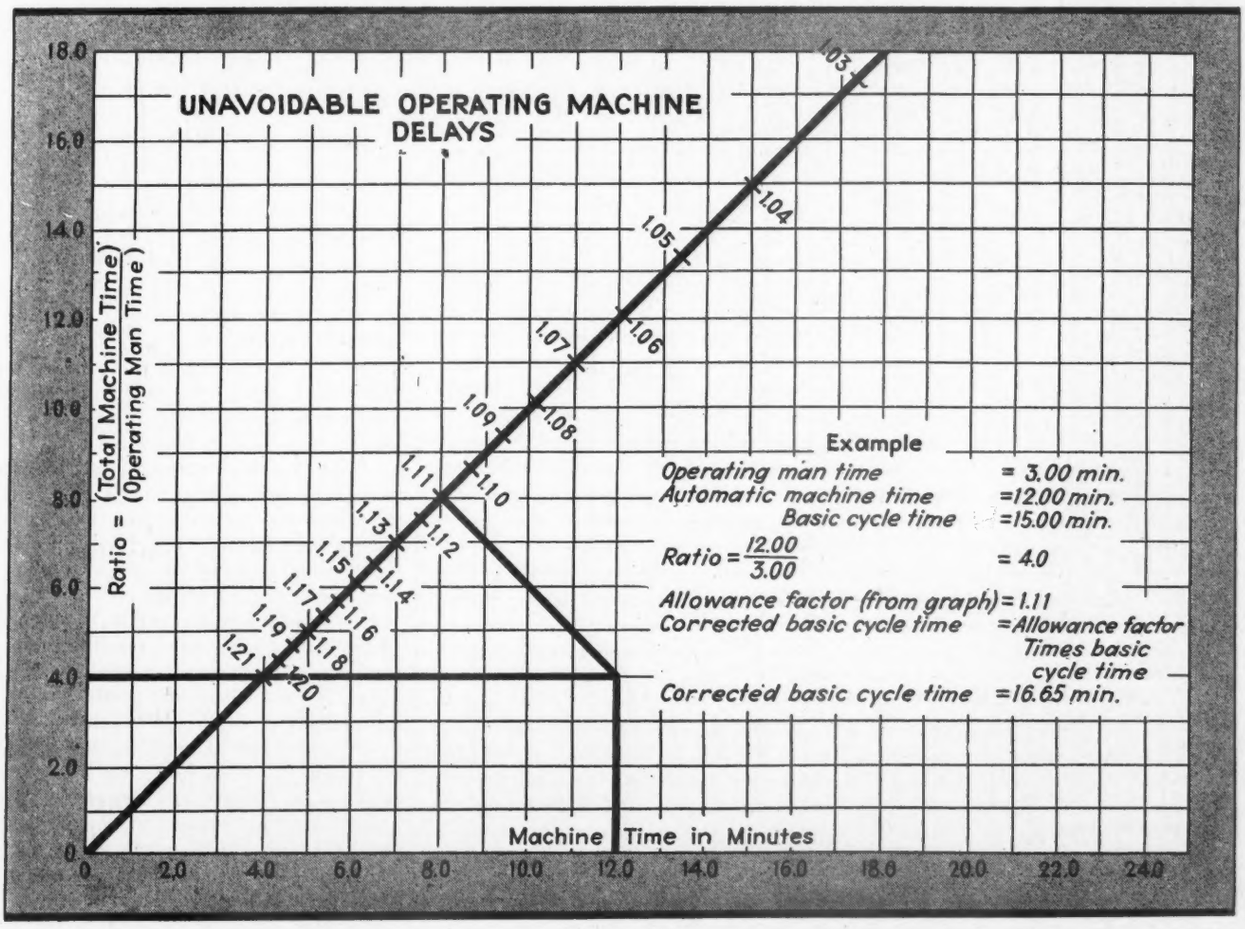



**Figure 1. When one man tends several machines, it is inevitable that while he works on one others must wait. Therefore each machine's basic operating time must be corrected by an allowance factor which is determined from this graph**

bonus he would have had he been operating 100 percent of the standard machines. When arriving at the allowance formula, it will be necessary to make provisions for deducting a portion of the gain time of the remaining machines operated for which allowances were made, such as the allowed man and machine waiting time.

This system can be made to function very simply by having each operator turn in a report (Figure 2), showing the machines and parts he worked on during the day. The factors are totaled, and when a man is operating less than 100 percent of the standard number of machines, an extension will be made and an allowance determined by referring to the allowance table.

To insure maximum departmental efficiency, the supervisor's bonus is based on machine efficiency and idle-man allowance of the entire department, in addition to other determining factors such as spoilage and supplies.

When multiple machines are grouped together in a battery, the prime labor is usually figured by dividing the actual elapsed time by the number of machines operated by one man. By analyzing the examples listed below it can readily be seen that this computation does not reflect a true cost. Example *B* also shows the prime labor cost distributed according to this system.

**Example B**

Assumption: 100 percent machine efficiency is maintained.

| *Job No.* | *Man Time* | *Cycle Time* | *Factor* | *Elapsed Time* | PRIME LABOR *Usual Method: ½ of Elapsed Time* | *This Method: Factor Times Elapsed Time* |
|---|---|---|---|---|---|---|
| 1. | 1.00 min. | 5.00 min. | .200 | 8 Hr. | 2 Hr. | 1.60 Hr. |
| 2. | 1.25 min. | 2.50 min. | .500 | 8 Hr. | 2 Hr. | 4.00 Hr. |
| 3. | 1.50 min. | 15.00 min. | .100 | 8 Hr. | 2 Hr. | 0.80 Hr. |
| 4. | 0.75 min. | 3.00 min. | .250 | 8 Hr. | 2 Hr. | 2.00 Hr. |
| | *Standard Hours of Work Performed* | | | | 8 Hr. | 8.40 Hr. |

If prime labor is valued at $1 per hour and 8.4 standard hours of work are produced in 8.0 hours, the actual prime labor cost for allocating purposes would be $.952 per hour. When an incentive is applied, the premium would be computed on the basis of standard hours of work performed as compared to actual hours worked.

A comparative prime labor cost analysis would reveal:

| *Job No.* | *Usual Method at $1.00/Hr.* | *This Method at $.952/Hr.* |
|---|---|---|
| 1. | $2.00 | $1.53 |
| 2. | 2.00 | 3.81 |
| 3. | 2.00 | .76 |
| 4. | 2.00 | 1.90 |
| Total Cost | $8.00 | $8.00 |

Analyzing the above example, it can be seen that Job Nos. 2 and 3 would normally be charged with the same amount of prime labor, even though Job No. 2 absorbed over five times as much man attendance time as did Job No. 3.

To further emphasize this, if job No. 2 were replaced by jobs having the same man and cycle times as Job No. 3, the operator could have operated approximately eight machines, or the equivalent, with the same amount of effort expended. When burden is based on direct prime labor the error is magnified, and consequently the final analysis on a certain job may reveal a profit when truly it should show a loss.

Often because of pressing production requirements it is found necessary to run an automatic machine when no additional automatic machines are available to insure an economical grouping. When such a condition arises, the operator could perform during the automatic machine time a job that would normally require 100 percent

(*Continued on page 140*)

INDIVIDUAL OPERATOR'S ANALYSIS ON MULTIPLE MACHINES

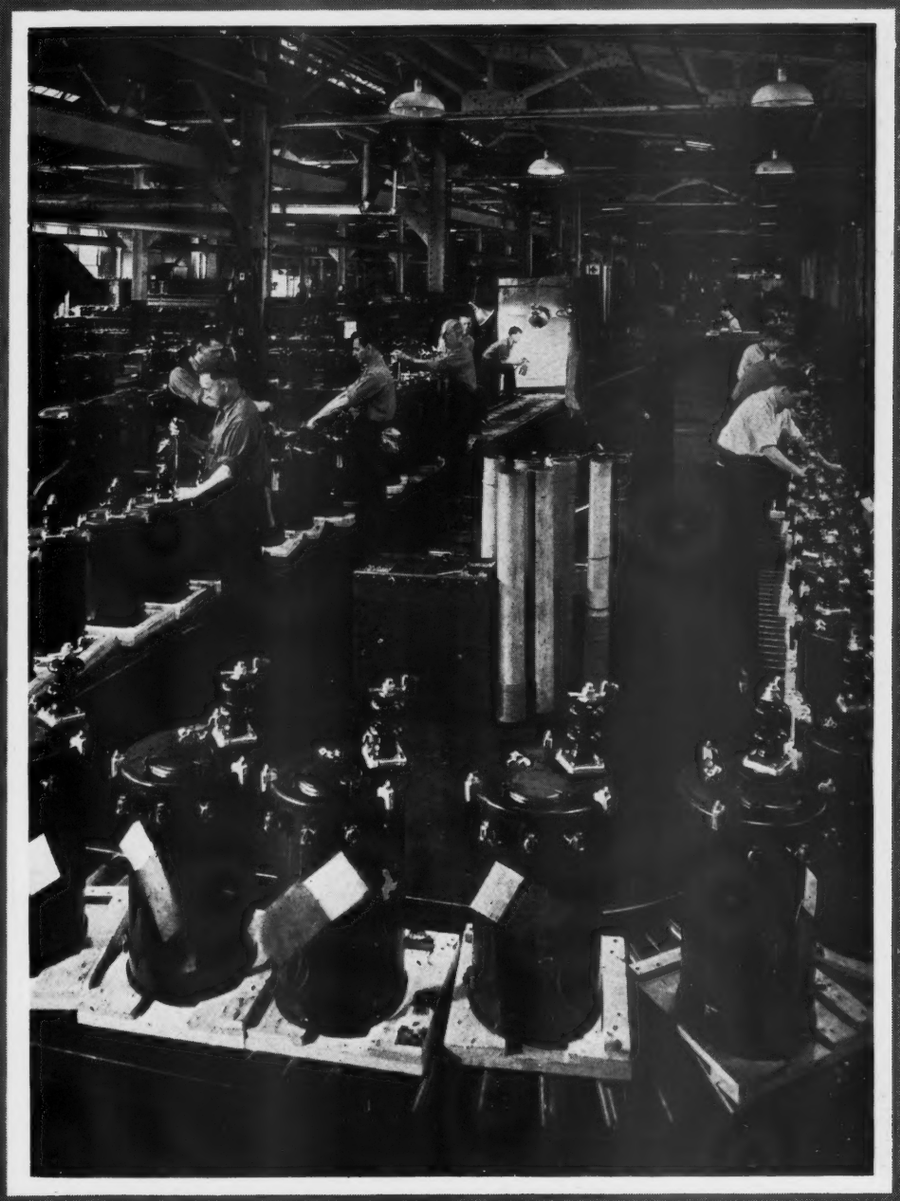
CLOCK NO.:_____
DATE:_____
DEPT.:_____

Idle-Man-Time Allowance for Multiple Machine Batteries

| Day Shift | 2nd Shift | 3rd Shift | MACH. No. | MACH. No. | MACH. No. | MACH. No. | MACH. No. | MACH. No. | MACH. No. | MACH. No. | % of Standard Number of Machines Operated | Elapsed Time | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7.0 | 3.0 | 11.0 | | | | | | | | | | | |
| 7.5 | 3.5 | 11.5 | | | | | | | | | | | |
| 8.0 | 4.0 | 12.0 | | | | | | | | | | | |
| 8.5 | 4.5 | 12.5 | | | | | | | | | | | |
| 9.0 | 5.0 | 1.0 | | | | | | | | | | | |
| 9.5 | 5.5 | 1.5 | | | | | | | | | | | |
| 10.0 | 6.0 | 2.0 | | | | | | | | | | | |
| 10.5 | 6.5 | 2.5 | | | | | | | | | | | |
| 11.0 | 7.0 | 3.0 | | | | | | | | | | | |
| 11.5 | 7.5 | 3.5 | | | | | | | | | | | |
| 12.0 | 8.0 | 4.0 | | | | | | | | | | | |
| 12.5 | 8.5 | 4.5 | | | | | | | | | | | |
| 1.0 | 9.0 | 5.0 | | | | | | | | | | | |
| 1.5 | 9.5 | 5.5 | | | | | | | | | | | |
| 2.0 | 10.0 | 6.0 | | | | | | | | | | | |
| 2.5 | 10.5 | 6.5 | | | | | | | | | | | |
| 3.0 | 11.0 | 7.0 | | | | | | | | | | | |
| 3.5 | 11.5 | 7.5 | | | | | | | | | | | |
| 4.0 | 12.0 | 8.0 | | | | | | | | | | | |
| 4.5 | 12.5 | 8.5 | | | | | | | | | | | |
| 5.0 | 1.0 | 9.0 | | | | | | | | | | | |
| 5.5 | 1.5 | 9.5 | | | | | | | | | | | |
| 6.0 | 2.0 | 10.0 | | | | | | | | | | | |
| 6.5 | 2.5 | 10.5 | | | | | | | | | | | |
| | | | | | | | | | | | | | |

Elapsed Machine Hours

**Figure 2. Each operator reports the machines he has worked on during the day and the time spent on each. If he has worked on less than the standard number, an allowance must be made so that his computed efficiency (hence his bonus) does not suffer**



# A Point Plan for Rating Jobs

What's a job worth? What yardstick to use? This practical point plan helps you rate factory jobs according to skill, effort, and working conditions. Simple to apply, it's also flexible enough to fit any plant's job-grading problem


N. G. MILLS

*Supervisor of Time Study*
*Westinghouse Electric & Manufacturing Company*
*Sharon, Pa.*



Forty-third in the Series of FACTORY MANAGEMENT and MAINTENANCE Plant Operation Library

# A Point Plan for Rating Jobs

At our Sharon Works we have developed and placed in effect a point plan for analyzing and rating jobs. This plan, which has already been in operation for four years, is a management tool for accurately measuring the factors that are fundamental and common to all occupations but which exist in relatively different amounts in each. These are the factors of *skill, effort,* and *working conditions.*

Skill and effort are required in all occupations in some degree. From the standpoint of job analysis we consider them the most important factors in establishing a job's worth, and we have broken them down into six elements:

1. Blueprints
2. Set-ups
3. Difficulty
4. Accuracy
5. Responsibility
6. Variation

Each of these elements is in turn divided into five degrees, and each degree is assigned a point rating. This rating has been determined by a careful comparison of the importance of each element with that of every other element, and relative importance of the elements in the particular industry as compared with their relative importance in other industries.

### Working Conditions Elements

The factor of working conditions surrounding the job is divided into ten elements, each consisting of several degrees. The elements are:

1. Accident hazard
2. Fatigue
3. Eyestrain
4. Heat
5. Cold
6. Acids
7. Dirt or dust
8. Weight
9. Fumes
10. Wet

Point ratings based on the relation of these elements, one with another, their relation to skill and effort, and again to the industry, have been assigned.

The detailed description of each of these groups of elements, in tabular form, is given on pages 65-68.

In the administration of the point rating plan the following procedure has been found to be advisable:

1. The analyst, who should possess a wealth of practical experience, must familiarize himself with the detailed elements involved in the job to be analyzed, and the responsibilities connected with the job, before attempting to select the proper point rating for each element. Extreme care must be exercised in evaluating the factors that definitely affect the job rather than the duties the operator may be asked to perform. The job, not the operator, is to be classified.

2. Select carefully the number of points to be allowed for each element of skill, effort, and working conditions, using the detailed write-up as a guide.

*Note:* After the analyst has become thoroughly familiar with the detail elements and their correct interpretations, as contained in the detailed descriptions, a job analysis key (Table I), giving in condensed form all information required to analyze and classify

## TABLE I. JOB ANALYSIS KEY

### Elements of Skill and Effort

| *Element* | *Degree* | *Point Rating* | *Element* | *Degree* | *Point Rating* |
|---|---|---|---|---|---|
| 1. Blueprints | Very complicated | 10 | 4. Accuracy | Very accurate | 20 |
| | Complicated | 8 | | Accurate | 15 |
| | Fairly complicated | 7 | | Fairly accurate | 7 |
| | Simple | 2 | | Ordinary | 2 |
| | Not required | 0 | | Rough | 0 |
| 2. Set-Ups | Very complicated | 10 | 5. Responsibility | Very responsible | 20 |
| | Complicated | 6 | | Responsible | 10 |
| | Fairly complicated | 3 | | Fairly responsible | 5 |
| | Simple | 1 | | Ordinary | 3 |
| | Not required | 0 | | Simple | 1 |
| 3. Difficulty | Very difficult | 5 | 6. Variation | Very variable | 10 |
| | Difficult | 4 | | Variable | 8 |
| | Fairly difficult | 3 | | Fairly variable | 6 |
| | Simple | 1 | | Repetitive | 2 |
| | None | 0 | | Highly repetitive | 1 |

### Elements of Working Conditions

| *Element* | *Degree* | *Point Rating* | *Element* | *Degree* | *Point Rating* |
|---|---|---|---|---|---|
| 1. Accident Hazard | Extremely hazardous | 10 | 6. Acids | All | 4 |
| | Fairly hazardous | 4 | | | |
| | Normally hazardous | 0 | | | |
| 2. Fatigue | Very fatiguing | 5 | 7. Dirt or Dust | Very dusty | 5 |
| | Standing | 4 | | Dusty or dirty | 2 |
| | Walking | 3 | | Normal conditions | 0 |
| | Sitting | 1 | | | |
| 3. Eyestrain | Extremely strenuous | 7 | 8. Weight | Hand-operated jib-crane lift | 8 |
| | Fairly strenuous | 3 | | Power-operated jib-crane lift | 7 |
| | Normally strenuous | 0 | | Shop-crane lift | 6 |
| | | | | Average hand lift | 3 |
| | | | | Light hand lift | 1 |
| 4. Heat | Extremely hot | 3 | 9. Fumes | Dangerous fumes | 2 |
| | Fairly hot | 1 | | Obnoxious fumes | 1 |
| | Normal | 0 | | | |
| 5. Cold | Outside without protection | 3 | 10. Wet | Heavy liquids | 5 |
| | Outside under cover | 2 | | Oily liquids | 2 |
| | | | | Plain liquids | 1 |

*Mr. Mills was born in Dunkirk, N. Y. Graduating from high school in 1910, he entered the Westinghouse 4-year machinist, tool-and-die making apprenticeship course at East Pittsburgh. After a few years of tool-and-die making and repair, he turned his attention to time study. Transferred in 1923 to the transformer division at Sharon as supervisor of equipment and methods; since 1933 has supervised operation analysis and time and motion study. His education has been supplemented by business administration and advanced drawing courses. He has also conducted motion study classes for the Methods Engineering Council, Pittsburgh. He's a 30-year man at Westinghouse*

all plant jobs, may be used exclusively.

3. Select proper occupation classification from point value conversion chart (Table II). The "point value" is the sum of all element ratings.

4. Record point selection, total points allowed, and corresponding class on back of job specification card (Figure 1) for permanent record. *Note:* The job specification card, showing occupation description and operator's qualifications on the front and details involved in measuring the classification on the back, is maintained as a permanent record, evidence of the judgment and reasoning exercised at the time of analysis. Occupation changes after the original analysis has been made, will justify a change in point selections, which may or may not affect the class. It is recommended that job specification cards be reviewed once a year, thus assuring that this phase of industrial relations is being followed carefully. These cards are made up in quadruplicate and files are maintained by the industrial relations department, factory superintendent, division general foreman, and department foreman.

5. All occupations are classified by the rate and occupation committee, with the cooperation of the time study supervisor, department supervisor, and any other persons who can contribute to completeness of the classification.

## Rate Range for Each Class

After the occupation has been analyzed, recorded on the job specification card, and the proper class determined, the key sheet shown in Figure 2 is referred to for the range of rates that the industry can afford to pay for its various classes of occupations. Charted graphically, these rate ranges show a uniform and consistent increase of rates from the lowest to the highest class.

Here are some of the advantages we find in the point rating plan:

1. Provides a means of arriving at a relationship between jobs departmentally and interdepartmentally.

2. Establishes definite factors and elements upon which occupational wages can be based, thus avoiding the over- or under-payment of jobs of a similar nature.

3. Provides an accurate comparison between new jobs and existing ones, thus making it possible to keep wage rates in line. It features consistency.

4. Avoids a difference in wage level between departments or, in fact, in a community, for comparable work.

5. Provides a basis for the adjustment of occupational wages that are definitely out of line.

6. Can be clearly understood and administered by supervisors who have not had a great amount of experience in classifying work. In this respect it enjoys an advantage over the ranking method of classification where jobs are arbitrarily listed in order of skill or difficulty, because ranking of that sort can only be done with accuracy by men of long experience.

7. Provides a written record of the analysis and reasoning exercised when classifying a particular occupation. This record not only assures a willingness to classify correctly and fairly, but it serves as a reference for anyone who has an occasion to question its sincerity.

8. The record provides a basis from which to check when an occupation has changed in character.

9. Serves as a guide to the industrial relations department in selection of employees, because the job specification card offers a basis of comparison between the applicant's qualifications and experience and the requirements of the job.

10. Serves to point out many factors in industry that deserve and should be given consideration; e.g., blueprints and set-ups may be simplified; accuracy may be controlled by special equipment or gages; responsibility may be minimized by more adequate handling of equipment. Accident hazards, fatigue, or eyestrain may be minimized

## TABLE II. POINT VALUE CONVERSION CHART

| *Men* | | *Women* | |
|---|---|---|---|
| *Class* | *Point Value* | *Class* | *Point Value* |
| A-1 | 66 to 74 | CW-1 | 20 and above |
| A-2 | 55 to 65 | CW-2 | 17 to 19 |
| B-1 | 46 to 54 | DW-1 | 12 to 16 |
| B-2 | 39 to 45 | DW-2 | 8 to 11 |
| C-1 | 32 to 38 | EW | 0 to 7 |
| C-2 | 27 to 31 | | |
| D-1 | 22 to 26 | | |
| D-2 | 17 to 21 | | |
| E | 0 to 16 | | |
| EB (boys) | 0 up | | |

**With a job rating and classification plan in effect, the assembly tasks shown above are related to all other jobs so that all are paid equitably. Figure 1 (below) illustrates both sides of the job specification card—top, front; bottom, back. Point ratings and final classification assigned in the job analysis are permanently recorded on the back so that they are easily referred to**

or eliminated. Poor working conditions may be minimized or eliminated with the result of a lower point rating and likewise a lower classification.

11. The psychological effect that a well-organized plan has on workmen is of value to any industry.

When properly interpreted and applied, the point rating plan will result in a fair and relative classification of individual jobs. Its success is dependent on good judgment and common sense as applied by one who has had sufficient practical experience to determine the true relation between similar factors as they affect different occupations. Judgment of individual factors is more accurately and easily accomplished than the estimation of the general value of a job by the average grader. The factor point ratings lend themselves readily to evaluation, and have a base on which the relative values of all occupations may be compared. For these reasons we feel this plan is thorough, uniform, and simple in its application, as well as flexible enough to fit any condition. Thus it is extremely practical. No plan will evaluate every job perfectly, but a well-conceived plan will evaluate correctly 90 to 95 percent of the jobs.

The author wishes to credit Mr. R. C. Martz of our Time Study Department and Mr. H. F. Jacobsen, formerly of our Time Study Department and now with the American Steel & Wire Company, Cleveland, for their able assistance in helping to develop this plan.

SKILL & EFFORT

| POINTS ALLOWED | |
|---|---|
| | BLUE PRINTS |
| | SET-UPS |
| | DIFFICULTY |
| | ACCURACY |
| | RESPONSIBILITY |
| | VARIATION |

WORKING CONDITIONS

| POINTS ALLOWED | | POINTS ALLOWED | |
|---|---|---|---|
| | ACCIDENT HAZARD | | ACIDS |
| | FATIGUE | | DIRT OR DUST |
| | EYE STRAIN | | WEIGHT |
| | HEAT | | FUMES |
| | COLD | | WET |

METHOD OF PAYMENT

| | |
|---|---|
| | DAY WORK |
| | STD. TIME |
| | INDIVIDUAL |
| | IN GROUP |

TOTAL POINTS ALLOWED ____ CLASSIFICATION ____

DESCRIPTION OF WORK _____

DATE EFFECTIVE _____

| FOREMAN | GEN. FOREMAN | TIME STUDY SUP. | SUPT. | CC. RATE COMM |
|---|---|---|---|---|
| | | | | |

JOB SPECIFICATION—CHECK EMPLOYES

TO BE USED WHEN CHOOSING THE PROPER OPERATOR FOR THIS JOB
WHEN POSSIBLE FILL BY PROMOTION

OCCUPATION _____ NO. ____ CLASS ____ JOB NO. ____
DEPT. _____ SECTION NAME _____ SECTION NO. _____
THE WORKER
AGE LIMIT _____ MINIMUM WEIGHT _____

CHECK ONE SQUARE IF QUALIFICATION IS DESIRABLE AND TWO IF ABSOLUTELY NECESSARY.

| | | | |
|---|---|---|---|
| ☐ ☐ MAN | ☐ ☐ SPEAK ENGLISH | ☐ ☐ STRONG | ☐ ☐ GOOD MEMORY |
| ☐ ☐ WOMAN | ☐ ☐ READ AND WRITE | ☐ ☐ QUICK | ☐ ☐ READ PRINTS |
| ☐ ☐ TALL | ☐ ☐ GRAMMAR SCHOOL | ☐ ☐ CAREFUL | ☐ ☐ READ SCALE |
| ☐ ☐ MEDIUM | ☐ ☐ HIGH SCHOOL | ☐ ☐ PATIENT | ☐ ☐ USE JIGS |
| ☐ ☐ COLORED | ☐ ☐ TECHNICAL SCHOOL | ☐ ☐ OBSERVANT | ☐ ☐ GAUGES |
| | | ☐ ☐ ACCURATE | ☐ ☐ TEMPLATES |
| | | ☐ ☐ THOROUGH | ☐ ☐ MICROMETER |

TOOLS OPERATOR SHOULD OWN _____
TYPE AND SIZE OF EQUIPMENT _____
MATERIAL USED _____
NUMBER ENGAGED IN WORK _____ INSTRUCTION TIME _____
REMARKS—

JOB SPECIFICATION—CHECK EMPLOYES

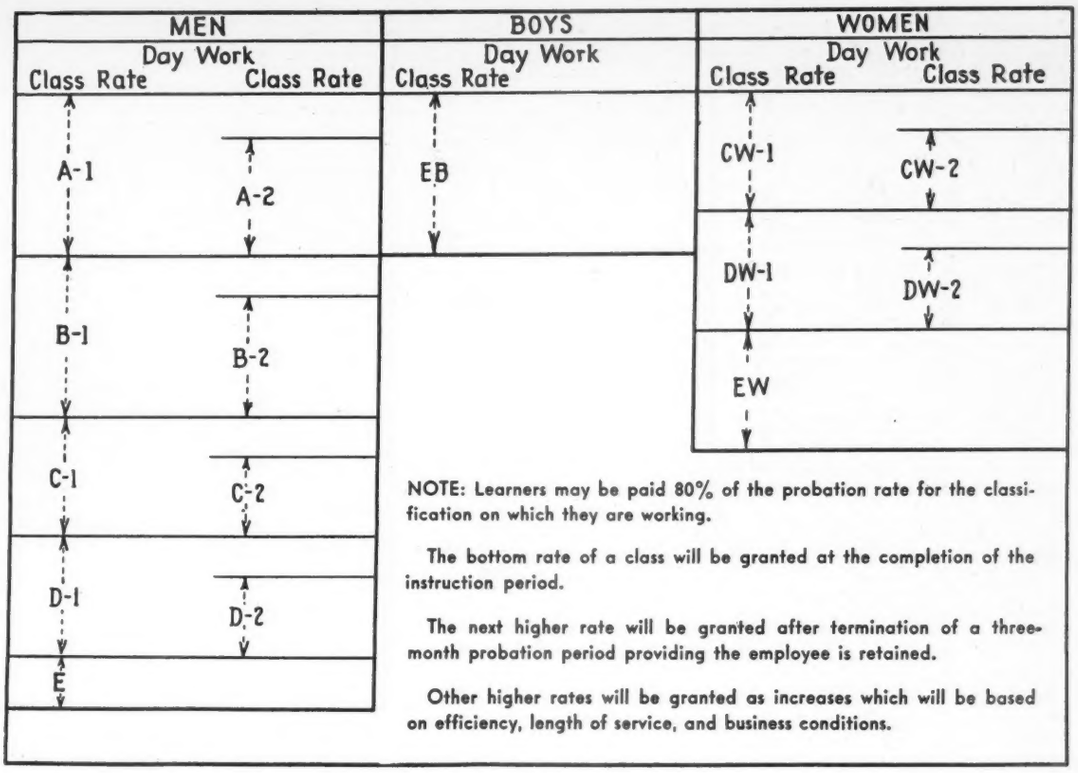



**Figure 2. Rate paid for any particular job is found on this key sheet which shows the spread of rates that can be paid in each job classification (as determined from Table II). These rate ranges represent a uniform rate increase from the lowest to the highest class**

# Elements of Skill and Effort

## 1. BLUEPRINTS

DEFINITION—Blueprints are the language by which the designer expresses his thoughts to the workman so that he may perform his work in an accurate, efficient, and workman-like manner.

EXPLANATION—Blueprints cover a broad field, from free hand sketches to the most complicated general assembly drawings or wiring diagrams. Their correct interpretation is very important.

Manufacturing drawings should be complete in all details; however, in rare cases the workman may be required to lay out and develop a part or calculate angles, chords, etc.

The factor to be decided upon is: How complicated are the blueprints involved in the job under consideration?

| *Degrees Established* | *Points* |
|---|---|
| Very complicated | 10 |
| Complicated | 8 |
| Fairly complicated | 7 |
| Simple | 2 |
| Not required | 0 |

APPLICATION—*Very Complicated.* Large complicated assemblies that involve a considerable amount of interpretation and imagination where details are not readily seen.

*Complicated.* Detailed prints of large and complicated work, such as large castings or parts that involve a considerable number of sectional views to show necessary details, and where it is difficult to locate and determine finished surfaces and dimensions. Large prints of a complicated nature, requiring some interpretation and study, such as wiring diagrams for large assemblies and prints that involve development. Toolroom work.

*Fairly Complicated.* Prints that show detailed items, where besides the usual three views sectional views are shown.

*Simple.* Standard prints that show detailed items with an average amount of dimensions, and which are not difficult to read. Example: Standard group drawings.

*Not Required.* No blueprint reading required.

## 2. SET-UPS

DEFINITION—All necessary work preparatory and following the completion of actual productive work.

EXPLANATION—This includes a wide range of operations from the getting of drawings and instruction to large complicated machine tool set-ups. It includes such operations as getting the job, all necessary information, drawings and tools, making set-ups on machine tools, assembly and wiring operations. Also, the breaking down of set-ups, returning tools, drawings, information.

| *Degrees Established* | *Points* |
|---|---|
| Very complicated | 10 |
| Complicated | 6 |
| Fairly complicated | 3 |
| Simple | 1 |
| Not required | 0 |

APPLICATION—*Very Complicated.* Where set-ups are very difficult, requiring great care, and where the final results are dependent mainly upon the skill of the operator.

*Complicated.* Where set-ups are complicated and the skill of the operator has an important part in the final results. Where center distances are important but difficult to maintain.

*Fairly Complicated.* Where set-ups require a degree of skill above the average and the final results are dependent partially on the skill of the operator. Where set-ups are

made using finished surfaces and layouts, jigs and fixtures; also for large and delicate work which can be distorted if care and judgment are not used by the operator.

*Simple.* Where normal set-ups are required on the average job, including set-ups of small and medium-size work, where a fair degree of care must be exercised.

*Not Required.* No set-ups required.

## 3. DIFFICULTY

DEFINITION—Work that is complicated or hard to do.

EXPLANATION—Difficulty is brought about by many conditions; namely, the size of work, tolerances and finishes required, problems that must be worked out by the operator, inconveniences under which the operator must work, the complications that are involved, and many others.

| *Degrees Established* | *Points* |
|---|---|
| Very difficult | 5 |
| Difficult | 4 |
| Fairly difficult | 3 |
| Simple | 1 |
| None | 0 |

APPLICATION—*Very Difficult.* Where a combination of conditions is involved, such as a great number of complications, difficult problems for the operator to solve, exceptional inspection requirements, inconvenient working conditions.

*Difficult.* Where the combination of conditions is less involved than stated above, or where at least one or two conditions are outstandingly difficult.

*Fairly Difficult.* Where one or two conditions involve a degree of difficulty that is more than ordinary.

*Simple.* Where conditions involve nothing over and above the minor difficulties expected on the average job.

*None.* Where conditions present no particular difficulty.

## 4. ACCURACY

DEFINITION—Accuracy is expressed by precision or exactness, also by exact conformity to a standard.

EXPLANATION—Accuracy is to be applied in a broad sense to cover all occupations. In some instances there are various degrees of accuracy to be considered, each requiring different degrees of effort and skill, such as mechanical tolerances or its equivalent; i.e., arc welding, where the welder has to produce an oil-tight weld which will be subjected to pressure or X-ray test. In other cases there is only one degree of accuracy—the work performed is either right or wrong as in the case of electrical work where a slight mistake may be serious.

| *Degrees Established* | *Points* |
|---|---|
| Very accurate | 20 |
| Accurate | 15 |
| Fairly accurate | 7 |
| Ordinary | 2 |
| Rough | 0 |

APPLICATION—*Very Accurate.* Where tolerances are less than 0.001 inch.

*Accurate.* Where tolerances are from 0.001 to 0.002 inch. All work where there is only one degree of accuracy, such as electrical wiring, test floor, etc.

*Fairly Accurate.* Where tolerances are 0.003 inch or larger. Assembly work where a fair degree of accuracy is required to permit proper functioning and where the operator must make the necessary adjustments to meet this condition. This also includes the fitting of medium and large-size vessels, and arc welding of vessels requiring an oil-tight pressure weld.

*Ordinary.* Where the tolerances are scale dimensions. Includes all structural welds.

*Rough.* Where small fractions are unimportant and rough dimensions permissible.

## 5. RESPONSIBILITY

DEFINITION—Responsibility means being accountable for value, safety, and quality.

EXPLANATION—*Value.* This applies to the value of materials and equipment used by the operator. The use of expensive materials and equipment constitutes a high degree of responsibility only to the extent that if a slight mistake is made it will result in a loss.

*Safety.* This applies to the extent to which an operator may cause injury to himself or others if he makes a mistake. Consideration must be given to safety devices installed to reduce the chances of accidents.

*Quality.* This applies only to the operator whose responsibility it is to make decisions on quality. Where inspection decides on quality, no part of this responsibility should be passed on to the operator. Quality workmanship is expected from the operator.

| *Degrees Established* | *Points* |
|---|---|
| Very responsible | 20 |
| Responsible | 10 |
| Fairly responsible | 5 |
| Ordinary | 3 |
| Simple | 1 |

APPLICATION—*Very Responsible.* Where serious loss or injury may be the result of a slight error and where the chance of an error is great.

*Responsible.* Where the loss or injury is costly, but the chance of error is not as great as above.

*Fairly Responsible.* Where the loss or injury is less costly and where the chance of error is present but less likely to occur.

*Ordinary.* Where the loss or injury is moderate and the chance of error slight.

*Simple.* Where the loss or injury is slight and the chance of error negligible.

## 6. VARIATION

DEFINITION—The extent to which a job alters or varies.

EXPLANATION—Consideration must be given to the variety of problems involved and operations performed as well as the variety in size and shape of work.

| *Degrees Established* | *Points* |
|---|---|
| Very variable | 10 |
| Variable | 8 |
| Fairly variable | 6 |
| Repetitive | 2 |
| Highly repetitive | 1 |

APPLICATION—*Very Variable.* Where each job is different in size and shape, requiring different operations and involving different problems.

*Variable.* Where each job is different but has two or three pieces to the order. Where a variety of operations is required and a variety of problems is involved.

*Fairly Variable.* Where the variety of jobs is not great and the quantity on each order is fairly large. Where the variety of operations and the problems involved in those operations is just about similar.

*Repetitive.* Where few jobs are involved, the quantity large and having a similarity of operations and problems.

*Highly Repetitive.* Where only one or two jobs are involved and the quantity large. There is no variety.

# Elements of Working Conditions

## 1. ACCIDENT HAZARD

DEFINITION—The amount of risk or accident hazard connected with the job.

EXPLANATION—Consideration must be given to the type of risk and nature of the job involved.

| *Degrees Established* | *Points* |
|---|---|
| Extremely hazardous | 10 |
| Fairly hazardous | 4 |
| Normally hazardous | 0 |

APPLICATION—*Extremely Hazardous.* Where a job is of a very hazardous nature, such as testing transformers with high voltages or other operations of extreme risk.

*Fairly Hazardous.* Where a job is of above-average risk and the consistent danger exists that by small negligence or breakage of cables or chains an accident may occur, such as power press operators, shear-men, operators working in a department where heavy parts are continually handled overhead.

*Normally Hazardous.* Where jobs of nothing more nor less than normal risk are handled, such as average machine operations like drill press, milling machines, planer, screw machine.

## 2. FATIGUE

DEFINITION—The physical effort required to perform an operation.

EXPLANATION—The extent to which a job is influenced by physical effort must be considered.

| *Degrees Established* | *Points* |
|---|---|
| Very fatiguing | 5 |
| Standing | 4 |
| Walking | 3 |
| Sitting | 1 |

APPLICATION—*Very Fatiguing.* Where the largest part of the burden is continuously handled by the operator, such as moving heavy castings or molds or working in an unnatural position.

*Standing.* Where the nature of the job requires the operator to stand all day, such as a winder (large coils), arc-welder (tanks).

*Walking.* Where the job requires operator to walk most of the time, such as hooker-on, sweeper, material handler.

*Sitting.* Where the job requires operator to sit most of the time, such as winder (small coils) or certain bench work.

## 3. EYESTRAIN

DEFINITION—The effect of close work or light conditions upon the eye.

EXPLANATION—The eye is a very sensitive organ and all effects upon its delicate structure must be considered.

| *Degrees Established* | *Points* |
|---|---|
| Extremely strenuous | 7 |
| Fairly strenuous | 3 |
| Normally strenuous | 0 |

APPLICATION—*Extremely Strenuous.* Applies to a job under artificial light, which requires very close tolerances, as filing to a hair line, instrument making.

*Fairly Strenuous.* Applies to a job of above-average eye strain, which requires reading of scales for close tolerances, such as tool-making, assembling, adjusting of instruments; also includes effect of flashes upon the eye, such as are caused by arc or torch welding.

*Normally Strenuous.* Where jobs of normal eyestrain are involved.

## 4. HEAT

DEFINITION—The effect of high temperatures upon the human body.

EXPLANATION—This includes the effect of abnormally high temperatures upon the human body as caused by a furnace or other conditions, but does not include natural heat from the sun.

| *Degrees Established* | *Points* |
|---|---|
| Extremely hot | 3 |
| Fairly hot | 1 |
| Normal | 0 |

APPLICATION—*Extremely Hot.* Where a job requires operator to work continuously at a furnace and the body is exposed to extremely high temperatures.

*Fairly Hot.* Where operator is required to work part of his time near an open furnace, such as a small furnace in the forge shop. Also includes arc and torch welding.

*Normal.* Applies to all work not subjecting the operator to abnormal temperatures.

## 5. COLD

DEFINITION—The effect of low temperatures upon the human body.

EXPLANATION—This includes the effect of abnormally low temperatures upon the body.

| *Degrees Established* | *Points* |
|---|---|
| Outside without protection | 3 |
| Outside under cover | 2 |

APPLICATION—*Outside Without Protection.* Where the job requires operator to work continuously exposed to the weather, such as a stockman in the yard.

*Outside Under Cover.* Where the job requires operator to work outside, but under cover, such as a craneman in the yard, outside shotblast, truck drivers.

## 6. ACIDS

DEFINITION—All liquids containing acid.

EXPLANATION—This provides for working with acids.

| *Degrees Established* | *Points* |
|---|---|
| All | 4 |

APPLICATION—*All Acids.* Applied to such work as metal plating, cleaning of parts in acid, and other work of a like nature.

## 7. DIRT OR DUST

DEFINITION—The amount of dirt or dust surrounding the job.

EXPLANATION—This includes the effect of dirt or dust upon operators.

| *Degrees Established* | *Points* |
|---|---|
| Very dusty | 5 |
| Dusty or dirty | 2 |
| Normal conditions | 0 |

APPLICATION—*Very Dusty.* Where extreme conditions are involved, such as shotblasting large vessels, where operators have to work inside of the shotblast room.

*Dusty or Dirty.* Where conditions are above average, such as calker, hand grinder, shotblast operator outside of shotblast room, sweeper, or small-tool grinder.

*Normal Conditions.* Applies to all average working conditions, which are not particularly dirty or dusty.

## 8. WEIGHT

DEFINITION—Lifting weights and handling parts.

EXPLANATION—Consideration should be given the type of handling required.

| *Degrees Established* | *Points* |
|---|---|
| Hand-operated jib-crane lift | 8 |
| Power-operated jib-crane lift | 7 |
| Shop-crane lift | 6 |
| Average hand lift | 3 |
| Light hand lift | 1 |

APPLICATION—*Hand-Operated Jib-Crane Lift.* Where no other lifting equipment is available, and weight over 60 pounds is lifted by means of hand-operated chain block and moved about by physical effort.

*Power-Operated Jib-Crane Lift.* Applies where weight over 60 pounds is lifted by power unit and moved about by physical effort.

*Shop-Crane Lift.* For all handling of weights over 60 pounds if jib crane is not available. Weight is located and guided by physical effort. Example: Lower transformer into tank, turn transformer using turning cradle, guide and locate fabricated tank parts suspended from a crane.

*Average Hand Lift.* For all parts over 10 pounds in weight up to and including 60 pounds.

*Light Hand Lift.* For all parts of 10 pounds in weight or less.

## 9. FUMES

DEFINITION—The evaporation of liquids in the form of gas.

EXPLANATION—The extent to which an operator is exposed to inhalation of fumes.

| *Degrees Established* | *Points* |
|---|---|
| Dangerous fumes | 2 |
| Obnoxious fumes | 1 |

APPLICATION—*Dangerous Fumes.* Includes all fumes injurious to the human body, such as acid fumes, metal plating, tinning, spray painting, or metal spraying.

*Obnoxious Fumes.* Includes all fumes not dangerous to the organism, such as fumes in a dip room, arc welding with coated or bare electrodes, torch welding or fumes from flow or dip painting.

## 10. WET

DEFINITION—The necessity to work with liquids (not including acids).

EXPLANATION—Certain jobs require presence of water, oil, grease, which cause undesirable working conditions.

| *Degrees Established* | *Points* |
|---|---|
| Heavy liquids | 5 |
| Oily liquids | 2 |
| Plain liquids | 1 |

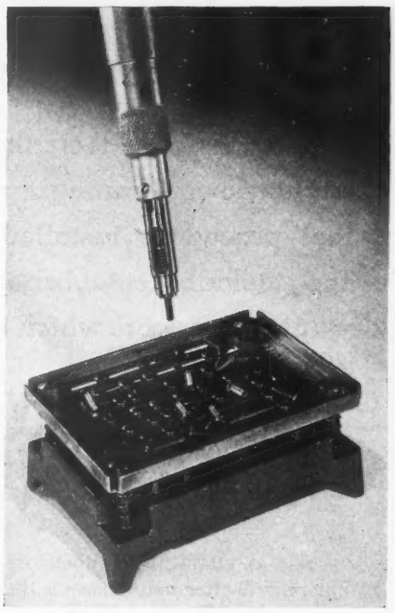
APPLICATION—*Heavy Liquids.* Includes all heavy liquids, such as paint applied by a flow or spray process.

*Oily Liquids.* Includes oil, grease compound, such as oil test vessels, all machine operations requiring the aid of a cutting compound, the handling of grease and other greasy substances; also includes painting with hand brush.

*Plain Liquids.* Where operator has to work with plain water, such as water test tanks.

# Easier, Faster Screwdriving

**Two devices used with a power-driven tool eliminate picking up screws with the fingers, make it possible to increase output several times without more effort**



Screws are picked up by forcing gripper in end of portable tool over the heads

EFFORTS TO FIND a better way of driving screws in some hard-to-reach places in an automobile radiator grill assembly have led engineers of Independent Pneumatic Tool Company, Chicago, to develop a new and highly effective technique. It is based on the use of two devices. One is a screw gripper attached to the end of a portable electric or pneumatic screwdriver. The other is a slotted tray which automatically places the screws in rows, heads up, ready for use.

Development of these two devices was a logical sequence of a study of the operations involved in driving screws in the conventional way. Simple but time-consuming, they involve picking up a screw in the fingers, turning it right side up, inserting it in the hole, and holding it in place until the finder of the portable screwdriver is placed over it. When screws are small or have to be driven in places that are difficult to reach the time required for the operations preliminary to the actual driving of the screw become disproportionately large.

It was seen that the solution of an important part of the problem lay in finding a way to grip the screw in the head of the driver. Therefore a gripping device termed the Pix-Up Finder was developed. This gripper is an extension-type finder in the screwdriving attachment of the portable tool. It is spring-hardened and has three longitudinal slots. Inside the lower end the finder is recessed to fit the size and type of screw to be driven. When the finder is placed above the head of a screw and pressed downward the screw enters the jaws of the device. With the screw thus firmly held in the screwdriver, the operator merely has to insert it in the hole and let the tool drive it home.

To eliminate the task of picking up screws in the fingers and turning them to the proper position for insertion, a container known as the Adjusto-Tray was designed. It is a slotted sheet-steel tray with flanged sides and ends which is spring mounted on a cast-iron base 4 inches wide and 5½ inches long. The height at which the tray is held above the base is regulated by clamp screws at the four corners and depends on the length of the screws used. The tray is set high enough above the base so that a screw hanging downward through the slot, and supported by the head, barely clears the base.

The operator merely guides the portable tool while it picks up a screw and drives it

In use, a quantity of screws is dumped into the tray which is then shaken a few times. The screws immediately slip through the slots and remain suspended by the heads. When the gripper in the end of the screwdriver is pushed down over a screw the tray is depressed so that the screw head is firmly held.

## 300 to 900 Percent More Screws

Since all handling of screws with the fingers is eliminated the operation of driving is reduced to two simple motions—pressing the screwdriver over the head of a screw in the tray, and inserting it in the hole.

Trays come in three sizes—for Nos. 3 and 4, for Nos. 5 and 6, and for No. 8 screws.

The pick-up device is available for round-head and flat-head screws in each of these sizes. It can be used with right-angle screwdriving attachments where space is restricted.

Experimental models of these new devices have been used for some months on assembly lines handling telephone equipment, unit heaters, automobile parts, refrigerators, and clocks. On these lines the number of screws driven per worker has been from 300 to 900 percent of customary performance.

# Tool Control Halves Inventory

**All wrong before, toolcrib technique is all right now. Thorough reorganization of tool procedure installed a toolmaker in the toolcrib, established simple but adequate paperwork which takes little time**


**G. M. DAVIDSON and W. S. HANSEN**

*Production Engineers*
*Harley Davidson Motor Company*
*Milwaukee*


HARLEY DAVIDSON MOTOR CO.
MILWAUKEE, WIS.

TOOL ORDER No. 65906

| CLOCK # | DATE | BIN NO. |
|---|---|---|
| 1617 | 10-8-40 | 256 |

| QUAN. | SIZE | DESCRIPTION |
|---|---|---|
| 1- | 1/4 X | 20 Tap |

REMARKS:

NOTICE: YOU ARE RESPONSIBLE FOR THE ABOVE ARTICLES: IF ABUSED OR LOST THEY WILL BE CHARGED TO YOU. RETURN THIS SLIP WITH THE ITEMS COVERED AND SECURE YOUR ORIGINAL WHITE RECEIPTED SLIP.

Signed John Doe

THIS ORDER FOR ONLY ONE KIND OF ARTICLE

**Each toolmaker has his own numbered pad with which to requisition the tools he needs. It is a triplicate, one-time carbon form**

IF OUR MAN IN CHARGE of the toolroom had not retired after a lifetime on the job, we should probably still be using the old brass check system. It worked well enough under his management, because he had a phenomenal memory and was so familiar with the small-tool stock that he could reach behind him without looking and put his hand on the $\frac{1}{4}$ x 20 NC tap that the toolmaker at the window was asking for. But when we had to substitute a new man, he was lost for weeks, while the toolmakers stood at the window in line, and the small tools disappeared into the toolroom and failed to come back. He moved on, and the next man had the same difficulties.

About that time we came to the conclusion that the real trouble was not in the men but in the job. So we sat down and drew up the specifications for what a toolcrib should ideally accomplish. It must, we decided, have on hand a stock of tools adequate to the needs of the department it serves—but not an oversupply of anything. It must provide instantaneously the whereabouts of any particular tool, so that if a shortage occurs the tool can be located and turned over to the toolmaker whose need is most urgent. It must have definite evidence that will convince not only the storekeeper in charge of the crib but also the man who borrowed the tool and now claims he never took it. It must provide prompt and complete inspection of condition of tools returned, and keep track of breakage and damage, preferably also providing information on which men do the damage. It should give the workman evidence that he can use to prove that he has returned a tool. Finally, it must give the men the tools they need, promptly, for a toolmaker is not accomplishing useful results while he is leaning on a window ledge waiting.

The first step was to discover exactly what stock of each tool was on hand. The results were illuminating, even though they made our faces red. Of some tools which are rarely used we had as many as eight or ten, gathering dust on the shelf. Of others, which are continually in use by several toolmakers, we had less than enough to go around. Moreover, the tools were piled together in such fashion that a cutting edge might get a nick or a burr from an adjoining item, and they were distinctly hard to find.

So we increased the size of the toolcrib, and equipped it with bins and shelving specifically designed for the purpose. We put in charge one of our older toolmakers, a man who not only is competent at the trade but also has a knack for neatness. He promptly rigged up an assortment of handy devices for keeping his stock handy and tidy. For example, two of the items that were always in the way and underfoot were heavy chain, kept in the bottom bin, and sash chain, which is drawn from production stock in hundred-foot lengths. In his spare moments our new crib clerk set hooks at one end of the steel shelving and hung his heavy chains on these.

**Filing unit at right holds original copies of tool requisitions filed by toolmakers' clock numbers. Pink carbons are clipped to inventory cards in unit at the left**

HARLEY DAVIDSON MOTOR CO.

**BROKEN OR DAMAGED TOOL REPORT**

Clock No. 1617 Bin No. 256

Dept. 16 Date 10-14-40

Part No.....

| SIZE | KIND OF TOOL OR GAUGE | VALUE |
|---|---|---|
| 1-1/4 x 20 N C | Tap | |

| REASON | DISPOSITION |
|---|---|
| Broken | SCRAP [X] |
| | SALVAGE [ ] |
| | REPAIR [ ] |

Foreman W. Petrie

BRING THE BROKEN OR DAMAGED TOOL TO THE CRIB WITH THIS TICKET FOR REPLACEMENT.

**Broken or damaged tools cannot be returned to the toolcrib until this form has been made out, and signed by toolroom foreman**

BIN NUMBER 256

Description: 1/4-20 N.C. Tap

TOOL OR COMMODITY NUMBER

INVENTORY

| DATE | IN | OUT | BAL | DATE | IN | OUT | BAL |
|---|---|---|---|---|---|---|---|
| Dec. 6,'39 | 7 | - | 7 | | | | |

**Requisitions are clipped to inventory card for that kind of tool to show how many are on hand and where they are at all times**

Then he rigged a cable spool on a bolt at the same end of the rack, spooled up his sash chain, and now draws it from overhead and cuts it off as he needs it.

Another advantage of having a competent journeyman in charge of the crib is that when some youngster needs a little advice on what tool to use for a specialized purpose, he can get it.

To permit the new equipment to function effectively we set up a system of paperwork which is extremely simple and still meets the requirements of our ideal specifications for a toolcrib. The basic unit is the pad of tear-off, carbon-backed tool-check forms. Each toolmaker has his own numbered pad, makes out at his bench the check which is really a triplicate requisition form. He fills in his clock number, date, quantity, size, description, and signs it. When he gets to the toolroom window he asks for the tool, and when the crib clerk hands him the tool he also speaks the bin number, which the toolmaker writes in. Then the toolmaker hands in the white original and the pink carbon copy, retaining the yellow carbon in the back of his book as his record of the tools he is being held responsible for.

The crib clerk has two filing units. One is the common grocery-store-type register, with a clip for each clock number represented in the toolroom. The white original goes there, along with the other slips representing all the tools the man has. The pink carbon copy goes into the larger register, which has a clip for each bin number in the crib. Under each clip is kept an inventory card, which shows on the face the inventory in and out—purchases and disposals, mind you, not loans to toolmakers. The pink slip is placed on top of this card, so that at any time the number of units of a given tool on the shelf, plus the number of pink slips above the inventory card, must equal the number of units shown on the card as our total stock.

When the workman brings back his tool, he also hands in the yellow slip that he has been holding. The crib clerk destroys the yellow slip, and hands the man the white original, which he ordinarily tears and drops in the waste-basket outside the window. The crib clerk now takes the pink slip from above the inventory card, slips it beneath the card, and it remains there until the end of the month. Beginning the first of the next month, the crib clerk counts the pink slips as he gets the opportunity and enters the number on the reverse of the inventory card, representing the tool activity. Then he throws away last month's pink slips.

## Had Too Few of Some Tools

Whenever the question arises of buying more tools, the tool activity is checked against the card inventory and the physical inventory. This method has actually decreased our total tool inventory by 50 percent. It has decreased by far more than 50 percent the inventory of some items, as is proved by the fact that it produced information which induced us to boost our inventory of several much-used tools.

For example, industrial diamonds for dressing wheels. We had always kept only one, because these are expensive and it seemed as if one should be enough for the toolroom. The records showed otherwise, and we added two more—thus doing away with delays which used to arise in tool production because a toolmaker had to wait until he could get the diamond to dress his wheel. Likewise, we had two 2-in. micrometers and two 3-in. micrometers. We upped these to three apiece, with excellent results.

When a workman brings back a broken or damaged tool, the crib clerk's experienced eye at once detects it—this, incidentally, is one of the major advantages of having a toolmaker behind the window. Instead of accepting the damaged tool, the clerk hands the workman a duplicate form to fill out—a broken or damaged tool report. The man fills in his clock number and department, the bin number, date, description, and description of the damage. Then he takes the tool and the forms to the toolroom foreman. The foreman signs the ticket to signify that he has inspected the damage, and he marks the disposition: scrap, salvage, or repair. The workman brings back the damaged tool and the duplicate signed damage report in order to get back his tool receipt. The crib clerk files one copy of the damage report in a special chronological file compartment, and forwards the other copy to the production engineering department. Here it is filed by the workman's clock number.

Like all descriptions of systems, this description makes our toolcrib system sound much more formidable than it really is. Actually, it is not at all formidable, is extremely simple. The tool check takes the workman only a few seconds to fill out, and the toolcrib clerk files each one immediately after giving out the tool—it takes him almost no time at all.

# Management Shorts

**Readers are invited to contribute brief articles, illustrated when possible, reporting out-of-the-ordinary management accomplishments. Accepted articles will be paid for**

## PRODUCTION PLANNING AND CONTROL

### Management Insures Itself Against Employees' Errors

SOURCE

*Ever Ready Label Corporation*
*New York*

For a great many years we were annoyed by the persistency of errors in our manufacture, which affected us seriously because we have a custom-made specially printed product. We were annoyed because there was no method of penalizing for errors without disturbing the relationship with the employees, and worse than that, there was no way of bringing home to the man who made an error, in some forceful manner toward an object lesson, the fact that he should share, as every one shares in life, some responsibility for the error.

We hit upon our Error and Penalty plan which went into effect the first of the year. To launch the plan management gave the sum of $1,250 to the Ever Ready Employees Club, $1,000 to be held in the club treasury and earmarked as a trust fund for twelve months, the balance of $250 guaranteed the club by the company.

When an error occurs in the manufacture of an order, a bill covering a rough estimate of the cost of materials spoiled and the cost of labor is presented against the club's treasury, together with the factory order and an explanation of the error. So that management may be reimbursed for the *cost* of the job, the employees will lose something of their $1,000 fund for every error that is made. *Selling* value is not considered in these charges against the club.

Should the error thus charged be a "stupid error," "avoidable error," or "inexcusable error" in the opinion of management, that fact is noted in a memorandum accompanying the bill. On these errors, the company reimburses on the same basis as others. The club executive committee sits in judgment on the man (or men) who caused the error and penalizes him (or them) so that their fund will not have to stand that particular charge.

The penalty is in cash, the offender paying the money into the club treasury. The penalty is "tempered by mercy" dependent on the job the man holds and the ratio of his responsibility to the situation. If in the judgment of the committee the man is "sick financially," it can then suggest to our vice-president that the man be allowed to

(*Continued on page 144*)

## Management, How Good Is Your Control?

***Ask yourself these questions to check up***

### 4. TRAINING

1. What is the state of training of old mechanics? Of old assemblers? Of others? Are you satisfied with the training of your personnel?
2. Have you a simple, result-getting training program in effect?
3. Does your program provide for training both old and new employees?
4. Is your training program progressive; that is, does it begin with simple work and gradually advance to more difficult?
5. Does your training program include retraining of old personnel in the proper motions and procedures for the work?
6. Do you make corrections at the moment they come to your attention? Have you trained yourself to observe carefully for errors? Do you wait until an event becomes hazy—both in your mind and in that of the person who committed an error—before making correction?
7. In training your group, do you follow the standard principles of instruction? That is, do you first *explain*, then *demonstrate*, call for individual *application*, and follow up with *examination, correction, repetition*?
8. Are assembling steps for various assemblies placed in writing? Can the sequences of any of these be combined or altered so as to reduce assembling time, without affecting quality of work?
9. Are standard parts cleaning, assembling, machine setting up, operating and cleaning motions and procedures in writing, to facilitate training and retraining and correction?
10. Does the training program provide for keeping your personnel abreast of all current developments in technique?
11. How do you test the training status of individual members of your group?
12. Does your training provide for giving special attention and assistance to those men whose outputs and quality of work are below average?
13. Which of your personnel are below average and need training right now?
14. How do you know which men are below average?
15. Do you know which men are expert at one operation or technique only?
16. Do you know which are expert at more than one operation or technique?
17. Through what medium do you keep abreast of developments in technique?
18. Do you train your men in economy of time and motions?
19. Do you limit your observation to the over-all completed job or do you extend it to observe the detailed processes involved?

***Next Month: Housekeeping***

*Prepared by* HARDING PALMER, *Industrial Engineer*
*Lockheed Aircraft Corporation, Burbank, Calif.*

# MAINTENANCE SERVICES

SELECTION

INSTALLATION

INSPECTION

UPKEEP

ORGANIZATION

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FACTORY MANAGEMENT and MAINTENANCE

McGRAW-HILL PUBLISHING COMPANY, INC., 330 WEST 42d STREET, NEW YORK, N. Y.

# EDITORIALS

L. C. MORROW . . . *Editor*

## Radiant Heating Has Much to Offer

UNUSUAL INTEREST has recently been aroused by what is known as radiant or panel heating, which is based on principles considerably different from those employed in conventional building heating systems. Briefly, the difference is that with ordinary systems the air is heated, whereas with radiant heating the walls, floor, or ceiling are heated, usually by embedded pipe coils.

To say that the principles or application of radiant heating are new is not strictly correct. Their application in a crude way goes back to the ancient Romans. The problem of utilizing these principles now rests on a much better foundation, however, because of our better equipment and knowledge of how the body disposes of its surplus heat.

This surplus must be disposed of at the rate of about 400 B.t.u. an hour. About 300 B.t.u. is dissipated by radiation and convection. When radiation accounts for about 190 B.t.u. and convection takes care of 110 B.t.u., maximum comfort results.

To feel comfortable in a room whose walls are cold, the temperature of the air must be fairly high. If wall temperature approaches 75 degrees Fahrenheit, an air temperature of 45 degrees or less is sufficient.

Radiant heating offers the opportunity of striking a suitable balance between dissipation of heat by radiation and by convection. Then there is a feeling of comfortable warmth, without the stuffiness felt in hot rooms.

Aside from greater personal comfort, radiant heating gives the advantages of better temperature distribution, absence of drafts, and higher fuel economy.

Some industrial installations of radiant heating have been made and others are now being put in. It bids fair to help industry find a better solution of an ever-present problem. That possibility alone would make it worthy of the most careful consideration.

## Costs Little, Pays Big, to Keep Safety Equipment in Shape

WE WENT TO THE MOVIES a couple of weeks ago. Not the Hollywood kind. Just a one-reeler shot at a Texas oil refinery. Showed how this company "launders" the respirators and goggles it requires its people to wear.

It was all very unpretentious. A domestic washing machine and two laundry tubs were all the equipment that was needed. Point is, it was a timely reminder of the need to keep safety equipment in perfect condition, and of the ease with which it can be done.

For instance, there are respirators *and* respirators. Some will just about keep out the flies. Others are scientifically constructed to provide sure protection against particles a fraction of a micron (1/25,000 of an inch) in size. But the best respirator is no better than its filter. The filter's the thing. A new one, and the respirator is every bit as good as the day it was purchased.

Remember, we ask operators to wear gas masks, respirators, goggles, or whatever. Let's be sure we picked the right equipment to begin with. And equally sure it will always do the job it was bought to do. It costs little to maintain safety equipment. The small cost is sure to return itself many times over.

## Bright

HEARD AT A CONFERENCE on multiple-shift operation:

"Do you find more spoilage during the second and third shifts than in the first?"

"We did, when multiple-shift operation was new. Of course we sought the cause. We quickly became convinced that it was faulty lighting. Our lighting was modernized and the spoilage at once fell back to the rate of the first shift."

## Put the Blame for Mistakes Where It Belongs

MAINTENANCE MEN make mistakes just like everyone else; sometimes are guilty of blunders that are both costly and difficult to explain.

In one plant we know about, when anything of this kind happens, the maintenance chief rakes *himself* over the coals. Little is said to the man who made the blunder, beyond calling his attention to what happened.

There are thought-provoking reasons behind this chief's method of handling a problem which every maintenance head has to deal with: If a man is incompetent or incorrigibly careless, he should not be in the maintenance department. If he has been given a task beyond his ability, or been allowed to work without the supervision he needs, it is not his fault. The chief himself is to blame, and should receive the reprimands.

Whether he is entirely fair to himself does not concern this chief. He is satisfied with the fact that in his department a mistake of any consequence is almost unknown.

# Rewired, Cut Upkeep 70 Percent

**Some new motors and proper balancing of the various loads also played an important part in bringing about additional savings of $3,500 each year in power losses**

G. A. VAN BRUNT
*Associate Editor*

A REDUCTION of about 70 percent in maintenance costs; savings in power losses that are estimated at $3,500 a year; and other highly important advantages that cannot readily be evaluated in dollars and cents—these are among the results brought about in the plant of the Bower Roller Bearing Company, Detroit, by completely revamping the electrical distribution and power equipment during the past five years.

These statements are not intended to imply that the equipment had been neglected to any unusual extent, or that it was in worse condition than the equipment in many other plants. Basically, most of the trouble lay in failure to appreciate the importance of properly planning for expansion. And, of course, the development of new types of equipment, makes it possible to secure results impossible 20 years ago.

This plant started operation more than 30 years ago. From that time on one addition after another was built to take care of increasing production requirements. Under the necessity of getting the new equipment into operation as quickly as possible, new circuits were tapped onto existing lines at the most convenient places. When existing lines became too badly overloaded, new feeders were run back to the transformer bank.

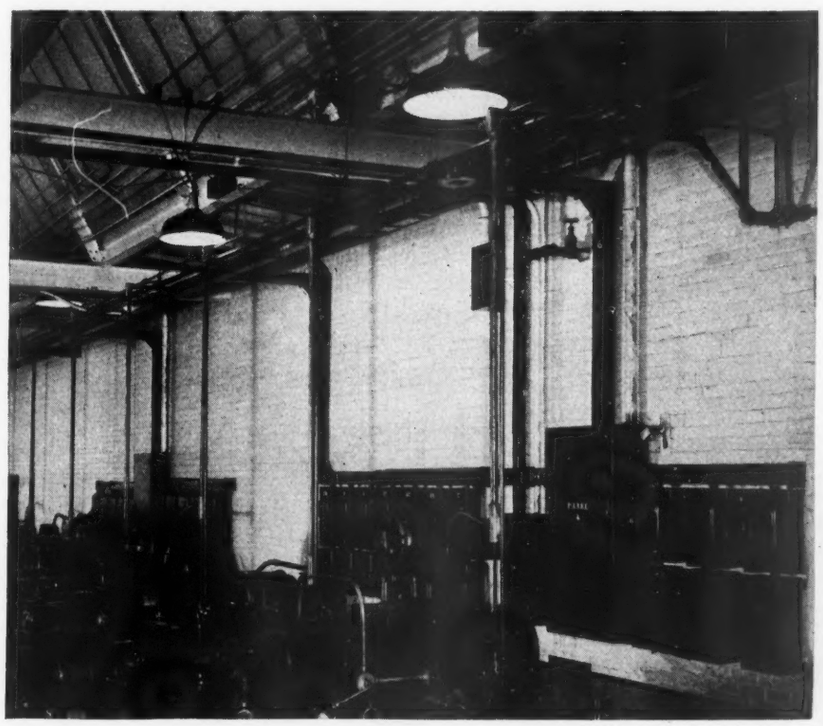
Also, in the earlier days of the plant certain installation procedures were followed that could hardly be called good practice today. For example, it was desired for one reason or another to run the secondary feeders outdoors, from the bank of three 333-kva., 4,800/220-volt transformers to the switchboard. The old-style transformers were located at one end of the building. Feeders were carried up to the roof and then across it for a distance of about 190 feet, until they dropped down to the distribution panels. Circuits were run from the panels to load centers.

This combination of long overloaded feeders run open and widely spaced resulted in excessive voltage drop and power losses which it is estimated amounted to about $2,000 a year.

Serious unbalancing of phases due to the operation of electric furnaces for heat-treating also caused trouble. There are in operation 38 furnaces, ranging from 60- to 333-kw. rating. All except two operate from a single-phase circuit. As these furnaces were installed, efforts were made to balance their load on all three phases. On the other hand, changes in production methods and operating schedules brought about a condition where some furnaces were operated for long periods and at different times than others. The natural result was heavy unbalancing of the loads on the different phases, even though each phase had about the same kilowatt load connected to it.

Overloads and unbalancing of phases naturally caused serious overheating of the transformers.

Considerable trouble was likewise experienced with motors. Low voltage and phase unbalance are inevitably reflected in poor performance. Some motors were overloaded and the fuses



**In the heavy automatic screw machine department, the main feeder cables are run overhead in the open. From them power is led through bus ducts to distribution panels serving groups of machines. All wiring between starters and machines is in conduit**

protecting them blew frequently. Furthermore the conditions in some departments—for example, dry grinding—were not conducive to long life of the open-type motors used.

As much as possible was being done to overcome some of the handicaps imposed by the inadequate electrical systems and keep production going with the minimum amount of interruption. Nevertheless, it became apparent several years ago that complete revamping of the power distribution systems and the installation of a considerable number of new motors offered the only real solution of these problems.

It has been extended over a period of several years, largely in view of the necessity of keeping production going with the least possible interruption. This consideration made it necessary to do much of the work piecemeal.

One of the first moves was to cut out the long secondary feedbacks from distribution panels to load centers, by running heavy busbars directly to the load centers closest to the transformer bank. Three additional banks of transformers, making six in all, were installed close to present load centers. The load on one bank is mostly heat-treating furnaces.

The size and proper location of this bank were fixed by a careful study of furnace operating schedules. This study showed that some furnaces were operated about 80 percent of the working time, while others were in service only about 30 percent of the time. In cooperation with the production department, schedules were worked out which make it possible to balance the furnace loads satisfactorily. Cooler operation of transformers and conductors followed.

As will be seen from the diagram, power is received at 4,800 volts from the Detroit Edison Company over three separate lines. Any one of these lines can carry the entire load of the plant. Two lines, fed from separate Edison substations, are normally in use. If an interruption occurs on one line, the other will take over the entire load. The third line is held as a spare.

It might seem that unnecessarily elaborate precautions have been taken against interruption of the power supply. Their value was proved, nevertheless, when gas which had leaked into a cable vault recently became ignited and destroyed the cables of the two supply lines normally used. In this emergency it required only a few minutes to cut over to the reserve supply line.

The next step was to go through each department in turn and replace all the old wiring. New feeders from the main distribution panels to the load centers now consist of cables having slow-burning insulation, run open on the ceiling. From these cables, power is fed to the trough wiring and bus duct distribution systems which are being installed in all departments. At present about a mile of trough and several hundred feet of duct have been put in.

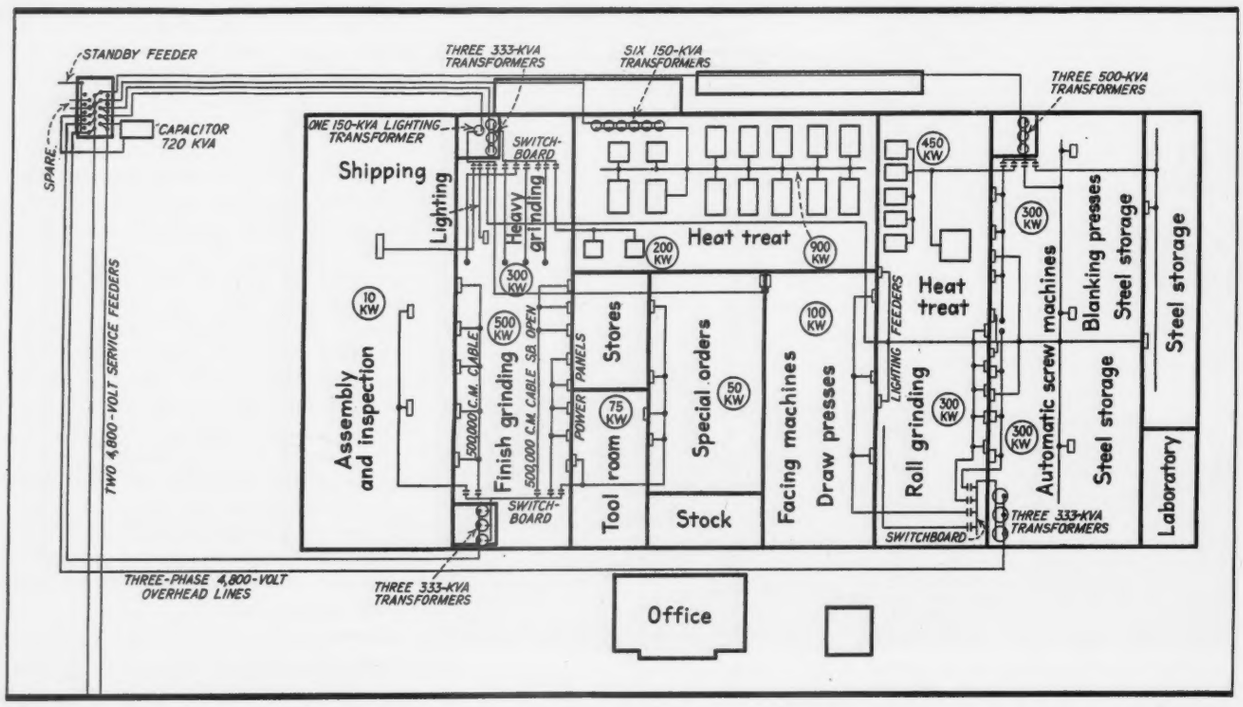
In the early days of the plant, the machines were driven almost exclusively from lineshafts. In view of the fact, however, that changes in machine location are frequently necessary, unit drive has in many instances been found to be better adapted to present needs. With unit drives and new types of flexible distribution systems, a machine can be plugged into a power line almost anywhere with the minimum of effort.

All wiring from ducts or panels to machines is, of course, run in conduit. Starters are usually mounted on the wall, while start-and-stop buttons are placed conveniently on the machines.

Along with these changes in the distribution system, as many as possible of the single-phase motors have been replaced with the three-phase type. Many old motors have been junked.

At present there are in operation about 1,400 motors ranging from fractional horsepower to 75-hp. rating. The average rating is about 5 horsepower.

Correction of power factor has been given a great deal of attention. In 1935 it was 76 percent. By changing feeders and remotoring machines so that motors operated at full load, the power factor was raised to 84.5 percent. Capacitors installed since January of this year have increased it to between 95 and 96 percent. The investment in this equipment, it may be interesting to note, returns 6 percent a month.




**The general layout of the electrical distribution system, as the rehabilitation program has revamped it, is shown in this diagram**

# HOW MAINTENANCE CAN

## Buildings

How Can You Get the Most Out of Your Buildings?

### FLOORS

1. Check suitability for service
2. Replace or repair defective portions
3. Use plates to protect where service is unusually severe
4. Strengthen supports to permit spacing machines closer or piling stock higher

### WALLS, CEILINGS, WINDOWS

1. Paint walls and interior surfaces a light color to increase reflective power and improve lighting conditions
2. Reglaze windows and skylights with heat-absorbing glass, or paint to reduce glare and heat
3. Repair and calk sash to reduce drafts and keep out rain

### RAMPS

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## Plant Services

How Can Your Plant Services Be Improved?

### LIGHTING

1. Check adequacy of illumination for kind of work performed
2. Study suitability of present lighting units for service conditions
3. Replace burned-out or blackened bulbs and defective reflectors
4. Establish suitable schedules for cleaning lighting units
5. Make sure that switching facilities are flexible and adequate

### HEATING, AIR CONDITIONING, DUST REMOVAL

1. See that heating system is adequate, efficient, and suitably controlled
2. Check condition of air conditioning equipment
3. Study advisability of air conditioning additional areas
4. Study need for dust and fume removal
5. Check efficiency of existing equipment

### MATERI

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3. Make sure
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4. Interlock
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## Service Equipment

### Electrical

How Can You Get the Most from Electrical Service Equipment?

### POWER SUPPLY

1. Make sure that the power supply is dependable and adequate for all requirements
2. Consider advisability of providing an auxiliary source for use in emergencies or at peak loads
3. Study utility contract to make sure that full advantage is taken of its provisions

### DISTRIBUTION SYSTEM

1. Check condition and adequacy as to capacity and flexibility
2. See that the system is sectionalized so as to confine trouble to small areas
3. Keep voltage drop within limits of good practice
4. Balance loads properly on all phases

### TRAN

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## Service Equipment

### Mechanical

How Can You Get the Most from Mechanical Service Equipment?

### POWER DRIVES

1. Check condition of all drives; repair or replace defective parts
2. Determine need for variable-speed drives. Check those used for speed range, ease, and accuracy of control.
3. Check suitability of all drives for service conditions
4. Determine where group and unit drives should be used for greatest economy and best results

### BEARINGS

1. Check condition and suitability
2. Consider advisability of replacing with other types having lower friction, better protection, or requiring less attention
3. Check adequacy of provisions for lubrication

### LUB

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# N AID THE NATIONAL PRODUCTIO

### RAMPS, DOORWAYS

1. Consider building ramps to increase effectiveness of power-driven and hand trucks
2. Consider reducing grade of existing ramps, to permit handling heavier loads
3. Widen doorways to facilitate use of power-driven trucks

### MEZZANINES

1. Consider advisability of locating sanitary facilities, inactive stock, parts, or tool storage and shop offices on mezzanines to release productive floor space or increase storage facilities

### ROOFS

1. Determine need for repair or replacement to prevent leakage or possible damage by high winds
2. Make sure that all flashings are in good condition
3. Consider insulating roof to reduce heat loss and condensation, and cut down temperature of workplaces in summer

**Output of every plant, n**

**dependent on the conditi**

**services provided for oper**

**will help you get the mo**

### MATERIALS HANDLING

1. Check condition of all equipment; repair or replace defective parts
2. Determine whether later or other types of handling equipment would be better suited
3. Make sure that spare motors and other parts are available
4. Interlock conveyors operating in sequence to minimize effects of trouble

### GAS, STEAM, AIR, WATER

1. Check adequacy and efficiency of supply
2. Inspect piping and valves for leaks and defects
3. See that all lines are properly equipped with gages, pressure-reducing valves, and other needed devices
4. Institute effective precautions to prevent wastage

### FIRE PROTECTION

1. Make sure that the character and amount of firefighting equipment are adequate
2. See that special hazards are properly safeguarded and given the best available protection
3. Instruct key employees in duties to be performed in emergency, including protection and salvage of equipment and materials

### COMMUNICATION

1. Make sure that there are adequate and efficient means of intercourse among all departments
2. Study need for a private telephone system
3. Consider advisability of putting in a loudspeaker or public-address system in production departments
4. Consider advisability of putting in paging system, to cut down waiting time

FACTORY M

### TRANSFORMERS

1. Check condition and adequacy of rating for present and future loads
2. Provide adequate protection from lightning
3. Determine whether later designs would cut power losses
4. Provide for quick restoration of service after failure

### DEMAND

1. If demand peaks are high consider possibility of reducing by changes in operating schedules
2. Study desirability of installing high-peak alarms or demand-limiting equipment

### MOTORS AND CONTROLS

1. Check condition and make sure that all are of proper type and rating
2. Make sure that all motors are properly loaded
3. Investigate desirability of replacing manually operated controls by magnetic or automatic types

### PROTECTIVE DEVICES

1. Check condition and setting or rating of all protective devices
2. See that all circuits and apparatus are properly protected against faults
3. Make sure that protective devices have adequate interrupting capacity
4. Protect fuses and other devices against tampering by unauthorized persons

### ELECTRIC

1. Consider advisa electric heat in forms
2. In existing applica that equipment best suited to t
3. Study advisability tomatic tempera all applications

### LUBRICATION

1. Determine best type for each application
2. Consider installing centralized systems or improved types of lubricating devices
3. Check lubrication schedules for adequacy
4. Consider putting lubrication on incentive basis

### COMPRESSORS

1. Check condition and adequacy for requirements
2. Determine whether later designs would cut cost of compressed air
3. Check leakage and wastage of air
4. Determine where fan air can replace high-pressure air from compressors
5. Provide suitable pressure controls

### PUMPS

1. Check condition and adequacy for requirements
2. Determine whether later designs would cut pumping costs
3. Make sure that pumps handling corrosive liquids are made of suitable materials
4. Check leakage and wastage of liquids handled
5. Consider necessity for automatic pressure or other controls

### VALVES AND PIPING

1. Check lines for leaks, corrosion, and general condition
2. See that suitable materials are used in lines handling corrosive liquids
3. Make sure that valves are of proper design for service
4. Make sure that lines are properly pitched, drained, supported, insulated

### TANK

1. Check for adequ tion
2. See that suppor tions are suita condition
3. Make sure that mable or da comply with a tions

# ICE CAN AID THE NATIONAL

### WALLS, CEILINGS, WINDOWS

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### BEARINGS

Check condition and suitability
Consider advisability of replacing with other types having lower friction, better protection, or requiring less attention
Check adequacy of provisions for lubrication

### LUBRICATION

1. Determine best type for each application
2. Consider installing centralized systems or improved types of lubricating devices
3. Check lubrication schedules for adequacy
4. Consider putting lubrication on incentive basis

### COMPRESSORS

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4. Check leakage and wastage of liquids handled
5. Consider necessity for automatic pressure or other controls

# AL PRODUCTION

**Output of every plant, no matter what it makes, is largely dependent on the condition and character of the housing and services provided for operators and machines. This check chart will help you get the most out of your plant and equipment**

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### COMMUNICATION

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3. Consider advisability of putting in a loudspeaker or public-address system in production departments
4. Consider advisability of putting in paging system, to cut down waiting time

Prepared and Published by

FACTORY MANAGEMENT AND MAINTENANCE

December, 1940

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NTROLS
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### PROTECTIVE DEVICES

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2. See that all circuits and apparatus are properly protected against faults
3. Make sure that protective devices have adequate interrupting capacity
4. Protect fuses and other devices against tampering by unauthorized persons

### ELECTRIC HEAT

1. Consider advisability of using electric heat in place of other forms
2. In existing applications make sure that equipment used is the type best suited to the service
3. Study advisability of putting automatic temperature controls on all applications

### INSTRUMENTS AND METERS

1. Investigate use of these devices to guide operators of machines and processes
2. Investigate use to show duty cycles and idle time of machines or departments
3. Investigate use in locating defects in electrical and mechanical equipment

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### VALVES AND PIPING

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4. Make sure that lines are properly pitched, drained, supported, insulated

### TANKS

1. Check for adequacy and condition
2. See that supports and foundations are suitable and in good condition
3. Make sure that tanks for flammable or dangerous liquids comply with all safety regulations

### PRODUCTION EQUIPMENT

1. Check alignment, foundations, and condition of all parts
2. See that provisions for lubrication are adequate
3. Consider use of vibration-damping materials and devices to reduce noise or vibration
4. Determine whether output can safely be increased by raising speed or otherwise
5. Make sure that drive meets requirements for power, speed range, accuracy of control

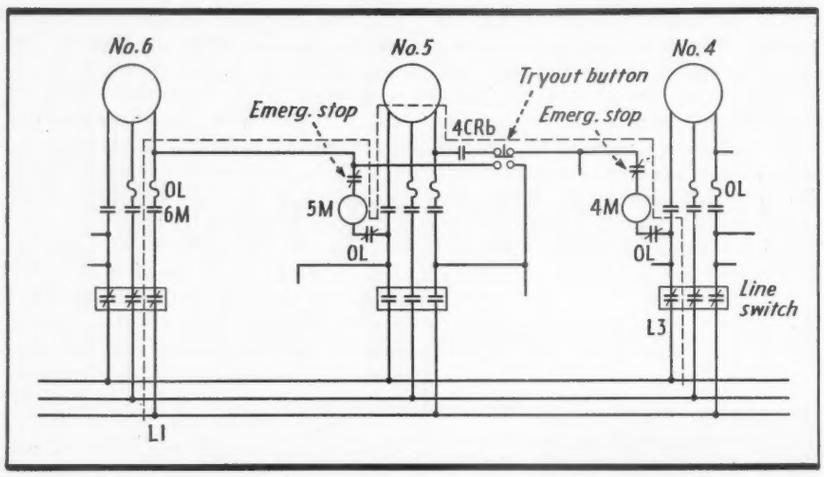


**Figure 2. Unless phases are reversed at, say, motor No. 6, a sneak current, shown by the dashed line, may hold starters 4 and 5 closed when they should be opened**

been thrown to the stop position during the emergency shutdown.

Conveyor belts usually include an automatic take-up device to maintain tension in the belt, which might otherwise be lost because of belt stretch and changes in length resulting from variable atmospheric conditions. These automatic devices may be equipped with a circuit-opening limit switch, which can be connected to stop the conveyor motor if the belt length increases beyond the limit of the device. Connections for this type of switch are shown at conveyor No. 1 in Figure 1.

Where the conveyor system consists of a number of belts means should be provided to operate each belt alone and independently of the remainder of the system for testing, inspection, or maintenance. This operation must of necessity be independent of the interbelt interlocking, and some method of preventing operation of the system to haul material is desirable. This feature is accomplished effectively by the use of a momentary-contact switch, which must be held down to cause the motor to run. Releasing the button stops the motor and returns the belt to the interlocked basis.

Connections for such a pushbutton are indicated for belt No. 5, involving the use of momentary make-and-break contacts. The make contact completes the circuit to the operating coil of No. 5 starter, while the break contact interrupts feed to the operating coil of No. 4 starter, so that the latter motor does not start. This pushbutton would normally be mounted near the starter, resulting in the disadvantage that it would usually be remote from the point of inspection.

There is considerable advantage in the repairman's being able to control any movement of the belt from a position where parts that are giving trouble can be observed while in motion. It can be provided by the use of a relay designated as *TR* at conveyor No. 4. The two control leads for the relay will be carried along the length of the belt in a conduit, with outlets at intervals. The pushbutton itself will be equipped with an extension cord for plugging in at the outlet nearest the scene of trouble. When depressed, the button energizes relay *TR*, and contact $TR_a$ operates the starter, while $TR_b$ interrupts the pilot circuit to No. 3 and No. 4 starters.

Safety to the repairmen while working on the machinery can best be guaranteed by padlocking the motor main circuit switch in the open position.

Where a conveyor system operates between a single loading and unloading point, the location of the master control station is of no particular consequence. The system illustrated in Figure 1 has three loading points, *A*, *B*, and *C*, and one discharge point *D*. This type of system can be operated most efficiently from three master control stations, one each at *A*, *B*, and *C*. Any of the stations will operate only that portion of the system involved between that particular loading point and the discharge end. Thus the station at *C* operates only belts No. 5 and No. 6; that at *B* operates only Nos. 3, 4, 5, and 6; and that at *A* operates all belts exclusive of No. 3.

It will be noted from the illustration that control station *C* closes relay *5CR*, contact $5CR_a$ closes relay *6CR*, and contact $6CR_a$ energizes starter No. 6 which in turn starts No. 5. Since contact $4CR_b$ is not closed, No. 4 does not start. Station *A* closes relay *2CR*, contact $2CR_a$ closes relay *4CR*, contact $4CR_a$ closes relay *6CR*. Contact $6CR_a$ starts No. 6 and No. 5 in order, and contact $4CR_b$ supplies energy to starter No. 4 while $2CR_b$ cuts in No. 2 and No. 1 starters in order. Starter No. 3 does not operate because contact $3CR_b$ is open. When operating from control station *B* only, contact $3CR_b$ cuts in No. 3 belt, but No. 2 and No. 1 do not operate because $2CR_b$ is open.

Operation of the stop buttons at any station will not interfere with operation from any other point. Thus, if stations *A* and *C* are both in operation and stop button *C* is operated, relay *5CR* opens but it does not remove energy from *6CR* which is also energized by $4CR_a$. Belts Nos. 6 and 5 therefore continue to run under control of *A* station.

A refinement in the control for a conveyor system similar to that shown in Figure 1 would consist in the use of a time interval between the automatic starting of successive belts, to prevent overlapping of the starting inrush of successive motors. Another feature might consist in the use of time delay shutdown after a master stop button has been pressed, as soon as loading has been completed. The delay in shutdown provides time for the last material loaded to reach the discharge point.

Both of these refinements require additional relays which could not be installed economically with standard starters, although the use of speed-responsive switches in the interbelt interlocking circuit, as described previously, will do much to keep starting peaks down.

## Trippers Operate Independently

Where a traveling tripper or shuttle drive is used with the belt at the discharge point, no interlocking of this motion with the remainder of the system is essential except possibly through the overload relay. Figure 1 indicates such a connection; that is, an overload on the tripper will stop the remainder of the system, but normal starting and stopping are entirely independent of the conveyor system.

The connections shown for the tripper control provide that the motor may be started in either direction from any intermediate position. If it is desired to move only to a new location, one of the directional buttons will be held down until the location is reached. To place the tripper in continuous, automatic reversing motion, the run button is depressed momentarily, in addition to the directional button.

# Just the Tank Needed, by Welding

**When tanks of odd sizes or special shapes are required, to be put in places where space is limited, it's not difficult to make up exactly what the job calls for**

WALTER J. BROOKING
*Engineering Department, R. G. LeTourneau, Inc.*
*Peoria, Ill.*

USE OF THE arc-welding process in fabricating special vats or containers designed to fit a certain place in the factory, may well lead to considerable savings. These savings derive from two important sources: First, the container can often be made from regular stock material, purchased in volume, by equipment and labor already at hand; second, the high service efficiency of the unit, due to the fact that it has been especially made for a certain capacity, space, and place in the factory. Low first cost cuts the burden of factory overhead; specialized functional design reduces the cost of operation to a minimum.

The tanks shown in Figure 1 could serve as examples of the use of arc-welded tanks to meet the requirements for oil, gasoline, water, or other liquid storage in any of a large number of medium-sized factories. Actually they were made to serve growing needs for oil and fuel storage at our plant. The two shown at the left were made first; the third was added later. The small space available for this tank simply resulted in the design of a taller tank of smaller diameter to meet the volume requirement.

The flexibility and ease of application of the arc-welding process made it possible to vary the design without losing the fundamental effectiveness of the unit, or causing any marked variation in the cost of material or time.

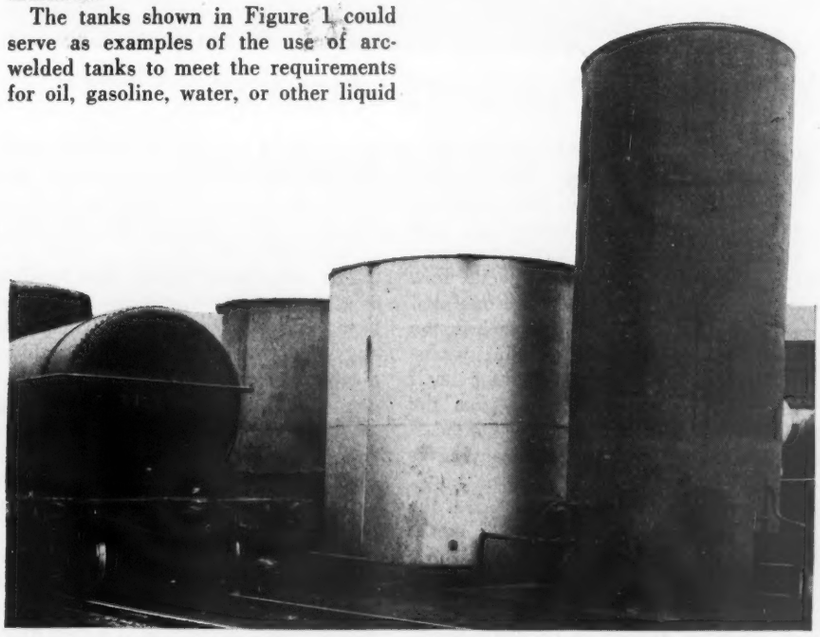

**Figure 1. These tanks were designed to meet certain space and capacity requirements**

In the heat-treating department two arc-welded tanks form part of the oil-quenching system. One tank is circular while the other is oblong. The oblong tank is more than 10 feet deep with the lower 8 feet below the floor level. Three pipes welded into the side are a part of the piping system used to draw the hot oil out of the tank, circulate it through an oil-cooling system outside the building, and return it to the tank, delivering a constant flow of cool oil. The tank itself is an excellent example of the simplicity of arc-welded design. A reinforced rim around the top gives added strength to resist such battering as the tank may get in service.

The plates for the sides and ends were cut in one piece and bent in a brake to save a weld the full height of the tank at each of two corners. Holes for the pipes were made with a flame-cutting torch and the pipes were welded oil-tight and rigidly into the tank side.

The vat or tank shown in Figure 2 is essentially an oblong steel vat, shown to illustrate the ease with which accessory pieces of machinery and fixtures may be welded to such a tank. It is a brine-quenching tank with an endless conveyor installed in it. Additional reinforcement members were welded to the tank for the driving motor bracket, conveyor mechanism frame, shaft bearings, and guide straps. The tank thus serves not only as a brine container, but also as a support for the conveyor mechanism.

## Pipe Lines Welded, Too

The small side tank at the right from which the brine flows is a part of the cooling system. The hot brine is pumped out of the tank through arc welded pipe lines to the cooling and storage tanks outside the building. Both of the tanks and their piping and fixtures are arc welded throughout.

An example of how a small, specialized container can easily and economically be made by arc welding is shown in Figure 3. It is an electrically heated oil tank which is used for preheating bearings for assembly. The unit is essentially a closed box made of steel

Figure 2. All attachments were welded to this tank, which is itself of welded design

plates, with a series of resistance heating units inside the tank near the bottom. A perforated steel plate was welded to the tank sides over the resistance units to form a false bottom which carries the load, protects the units, and allows free circulation of the oil as it is heated. The switchboxes, drain plug, oil seal retainers around the resistance units (where they enter the wall of the box), switchbox protective hood, and various other parts were all arc welded to the walls of the steel box at the time of installation.

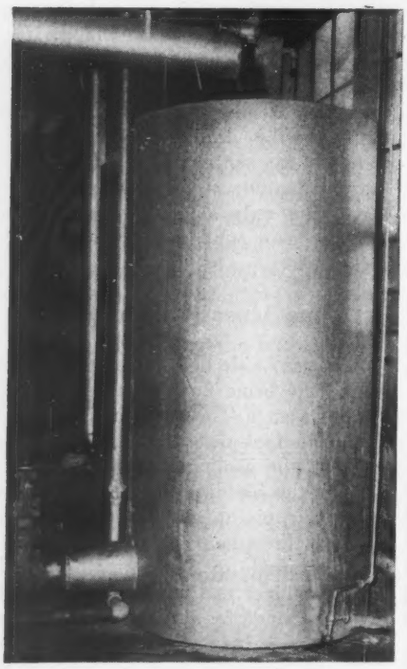

Figure 4. Tank and piping in a diesel engine cooling system are all-welded

The difference in the time required to assemble bearings when hot and when cold is relatively small; therefore the permissible cost of this special unit, at which it could be made and operated at a profit, was low. Nevertheless the welded design made it possible for us to build it and have it pay for itself in a relatively short period from the time it saved in the assembly of bearings. Since then it has been paying us a good profit.

The tank shown in Figure 4, and the pipes, valves, and other fixtures in the system of which the tank is a part, are all arc welded. They are part of the water-cooling system for a group of 22 diesel engines in the main power plant.

This tank is a simple cylinder made from a single plate, which was rolled and the ends arc welded together. A circular disk was welded to the lower end of the cylinder to form the bottom. Holes for the outlet pipes near the bottom were cut with an oxyacetylene torch and the pipes were arc welded to the wall of the tank. The inlet pipe at the top drains the large overhead water line. In making this assembly, a hole sufficiently large to make the inside diameter equal to the cross-section of the joining pipe was flame-cut into the overhead line; then the joining pipe was cut to fit the main pipe, and arc welded to it, making a strong, leakproof connection.

### Welded Right-Angle Bend

The right-angle bend immediately over the tank was made by mitering both the horizontal and vertical sections of pipe and welding them together.

Water flows from both directions in the overhead pipe line to the inlet pipe, into the tank and out the bottom, and is then drawn into the large pipe along the floor that supplies the individual motor cooling system.

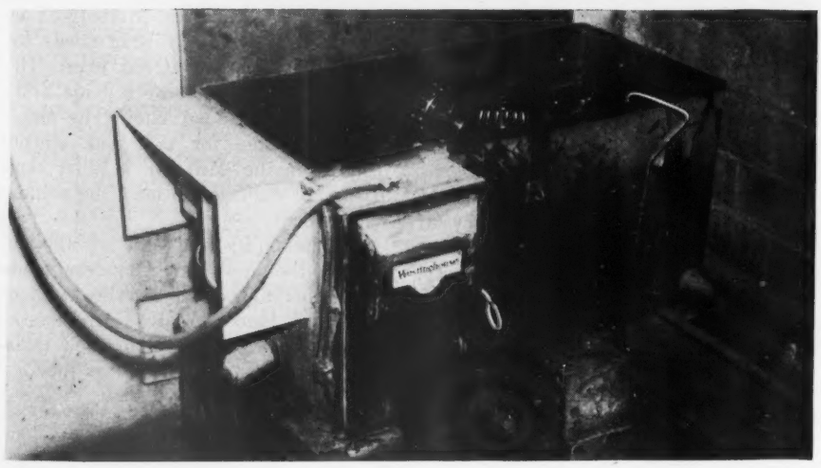

Figure 3. Even the heating units in a bath for heating bearings were welded in place

The fabrication, fitting, and welding of the piping are operations that could have been easily and quickly done in any factory that has an arc-welding machine, flame-cutting torch, and a good shop man possessing the usual amount of skill and ingenuity. Making such a tank then becomes merely a matter of sketching a plan and providing the necessary material for the workman.

In the course of a few hours the tank built to meet specific requirements can be finished and installed, ready for almost indefinite service at a cost which is comparatively small.

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# Maintenance Service Shorts

Readers are invited to contribute brief illustrated articles reporting out-of-the-ordinary maintenance accomplishments. Accepted articles will be paid for

## BUILDINGS, SERVICES, MAINTENANCE

### Welding Without Preheating for Stress Control

SOURCE
*The Linde Air Products Company*
*New York*

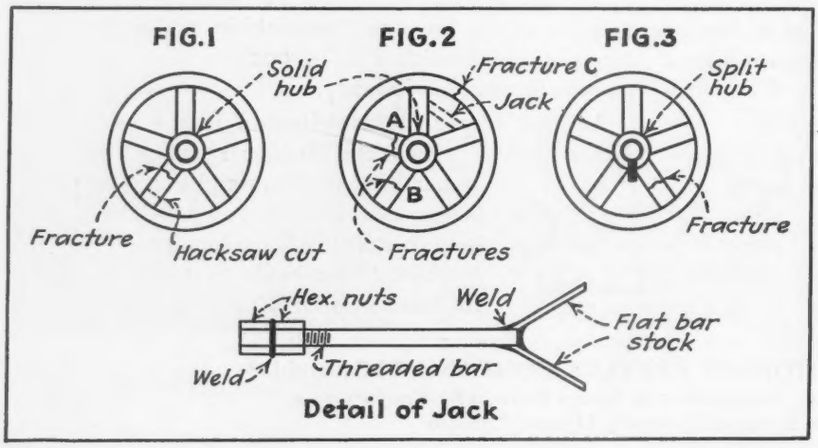
In bronze welding and fusion welding fractured cast iron pulleys or gears, control of expansion and contraction stresses during welding and immediately afterwards while the part is cooling, is usually accomplished by careful preheating, postheating, and controlled cooling. However, emergencies may arise when such practices might be impossible because of a lack of preheating facilities, or undesirable because the size of the part makes preheating uneconomical.

When a single spoke is fractured near the solid hub of a pulley (Figure 1), the stress-controlling procedure is relatively simple. The fracture is first veed from both sides, preferably by chipping. Then a hacksaw cut is made in the same spoke at a point close to the rim. This cut, however, is not made completely through the spoke, but preferably from both broad sides of the spoke in such a manner as to leave a strip of uncut metal about ¼ inch thick across the center section. The welding of the original fracture can then be carried on without special preheating. The additional opening, provided by the hacksaw cut, will permit expansion of the spoke while the fracture is being welded. The uncut section will keep the spoke in line.

After the welded fracture has cooled to room temperature, the hacksaw cut is welded closed. In order to obtain complete penetration, this portion of the spoke is first carefully veed by chipping. Because of the location of this weld, sufficient heat from the blowpipe flame will be carried over into the adjacent rim so that expansion will be taken care of by flexing of the rim.

When a combination of rim and spoke fractures exists, as shown in Figure 2, the order of welding is important. After the fractures have been veed, spoke welds *A* and *B* are completed in that order. Weld *B*, however, should not be attempted until weld *A* has completely cooled. When weld *B* has cooled to room temperature, a jack, such as is shown in the sketch, is employed before proceeding with weld *C*. The jack, placed between the spokes on either side of the rim fracture, is adjusted so as to force the fracture open approximately ⅛ inch. This clearance is sufficient to permit normal expansion of the rim during welding. After this final weld has been completed, the jack is removed and the weld is allowed to cool. It will be found that the resultant contraction will not cause a recurrence of the breakage in the rim and spoke.

With gears or pulleys of the split-hub type, a spoke broken adjacent to the hub (Figure 3) can be repaired readily without preheating. In this case the fracture is prepared for welding by veeing in the usual manner. Then a shaft, or section of a shaft, about ⅛ inch smaller in diameter than the bore of the hub, is inserted through the hub. Bolts are then applied and tightened until the split hub fits tightly around the shaft. As a result of this the portion of the broken spoke adjacent to the hub will be drawn away from the balance of the spoke and the fracture will be opened sufficiently to take care of expansion caused by the heat of welding. After the welding operation has been completed, pressure previously applied to the split hub is released by removing the hub bolts. This completes the repair and the part is allowed to cool, without danger of breakage due to subsequent contraction stresses.

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**When screwdrivers persist in slipping out of screw slots, try dipping the points in emery dust to better the grip.**

•

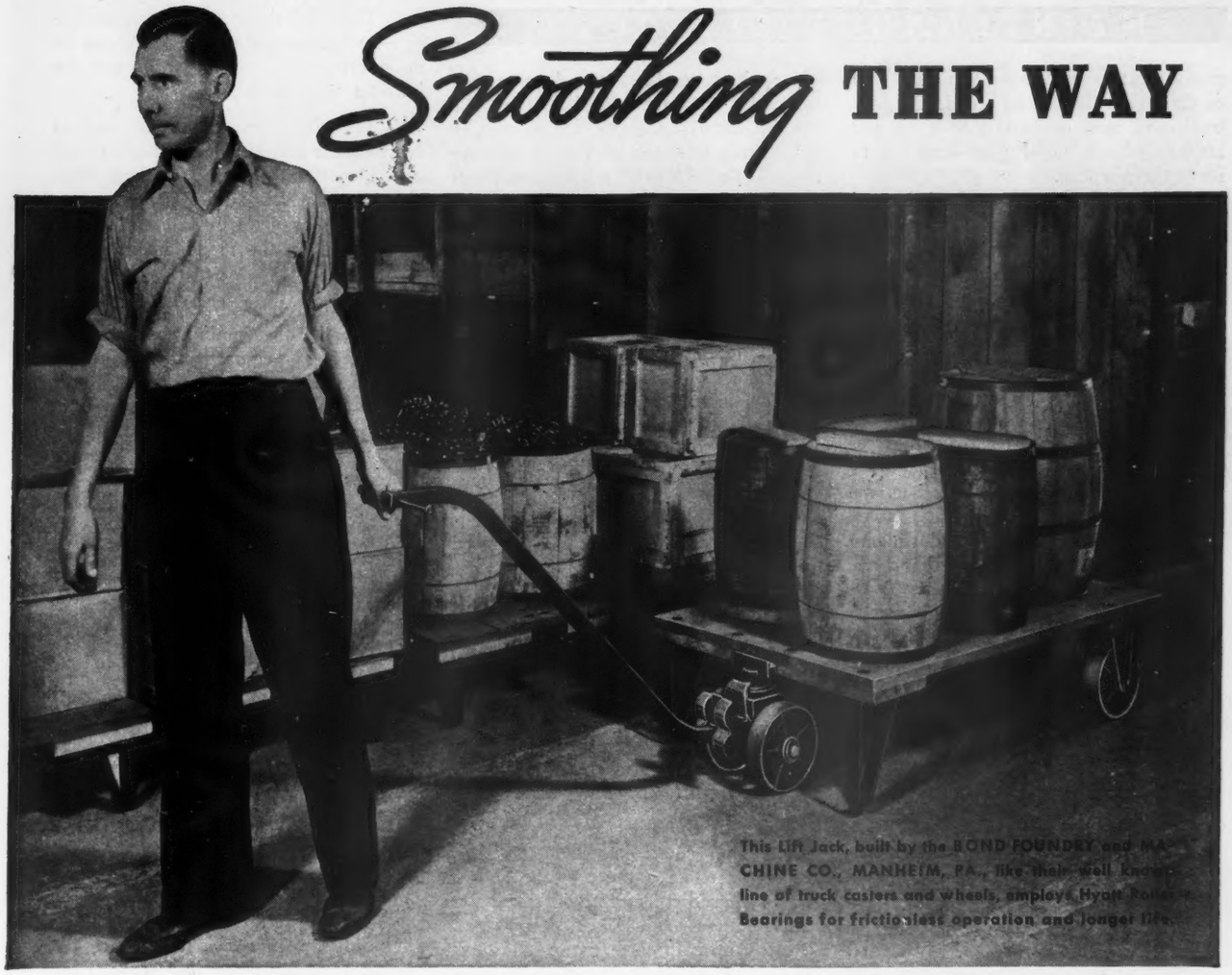
### Saved Enough Air to Shut Down One Compressor

O. F. LONG, *Memphis, Tenn.*

Some time ago we were confronted with the alternatives of cutting down our air consumption or buying a new air compressor. We were producing an average of 86 million cubic feet of air per month with four compressors, which served approximately 400 one-half-inch air connections throughout the plant. The majority of these connections were being used with the control valve wide open, and do what we would to convince employees that they would get just as good results with less air, we could not get them to open the valves only part way and thereby save air.

One of our maintenance men sug-

# *Smoothing* THE WAY



This Lift Jack, built by the BOND FOUNDRY and MACHINE CO., MANHEIM, PA., like their well known line of truck casters and wheels, employs Hyatt Roller Bearings for frictionless operation and longer life.

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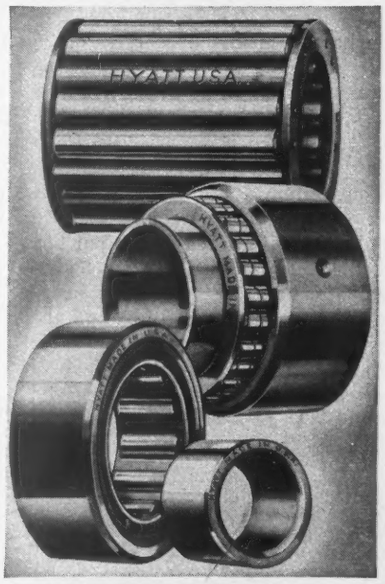



**HYATT**
ROLLER BEARINGS
QUIET

gested that we put thieves in each line so that regardless of how wide the control valve was opened only a limited amount of air could pass—enough to serve the purpose.

This suggestion was adopted, and over the weekend, while the plant was closed, the maintenance crew inserted a metal disk with a ⅛-in. hole in the center in each line, between the control valve and the fitting into which the valve was installed.

When the mill resumed operation the following Monday morning, we did not get a single complaint, nor did we receive any until some of the employees found out what had been done.

This little scheme permitted us not only to save purchasing an additional compressor but also to shut down one.

At a cost of $105.75 for labor and materials for installing the thieves we estimated a savings of approximately 30 million cubic feet of air per month. Our consumption dropped to an average of 57 million feet per month, representing a monetary savings of $990 per month, besides saving the cost of installing a new compressor. This is with an increased production schedule, too.

•

### Signatures Show That Bulletins Have Been Read

WM. P. HARSH
*Hall Brothers, Inc.*
*Kansas City, Mo.*

We have a maintenance crew of 26 people, including night watchman, carpenters, machinists, porters, and matrons. On issuing work bulletins in the past, it had been necessary to write a separate note to each person concerned, and on certain types of bulletins as many as 27 typewritten copies were required, as one is always kept in our file.

In the summer of 1938, we had a severe windstorm followed by a heavy rain. This came up suddenly and the watchman on duty was unable to close the windows before a great deal of water got in the building, and damaged some of our raw paper and finished stock. On questioning the watchman as to what his duties were in regard to windows, he seemed very vague on the subject—said he didn't remember receiving a bulletin telling him to keep the windows closed on Saturdays. We got out our file copy and showed it to him, but even then we were not able to convince him that he had received the proper instructions but had failed to follow them.

This incident really set up our new bulletin plan. It operates in this manner. Instructions are written on a full white sheet, and at the bottom are spaces for those concerned to sign their names. Each space has a man's name typewritten under it, and after reading the bulletin he is to sign his name. From there on there can be no question as to whether or not he read the bulletin.

This new bulletin system does five very important things for us:

1. It eliminates a great deal of typing time. Where many copies were previously typed, it is now necessary to make only two, one for our file and one for the men to read and sign.

2. These bulletins are kept on a clipboard near the time clock and form a permanent record for the maintenance department of plant policies, special jobs, and changes in routine.

3. They definitely assign responsibility—once read and signed there can be no question as to whether or not the bulletin was received.

4. They form a means for the men to review their orders. Often certain things are forgotten, and by reading back through these bulletins the men are enabled to keep up to date on policies established by the management.

5. They enable our building manager to review last year's bulletins and write new ones for the coming year. In September, it is necessary to outline the heating policies for the coming winter. This is made easy by the new system; he simply gets out last September's bulletins, copies those on which no changes are to be made, makes the necessary changes on the others, and writes what new ones may be needed.

## POWER AND LIGHT

### Fluorescent Lights Pep Up the Shop

L. N. STOWE, *Production Manager*
*United States Register Company*
*Battle Creek, Mich.*

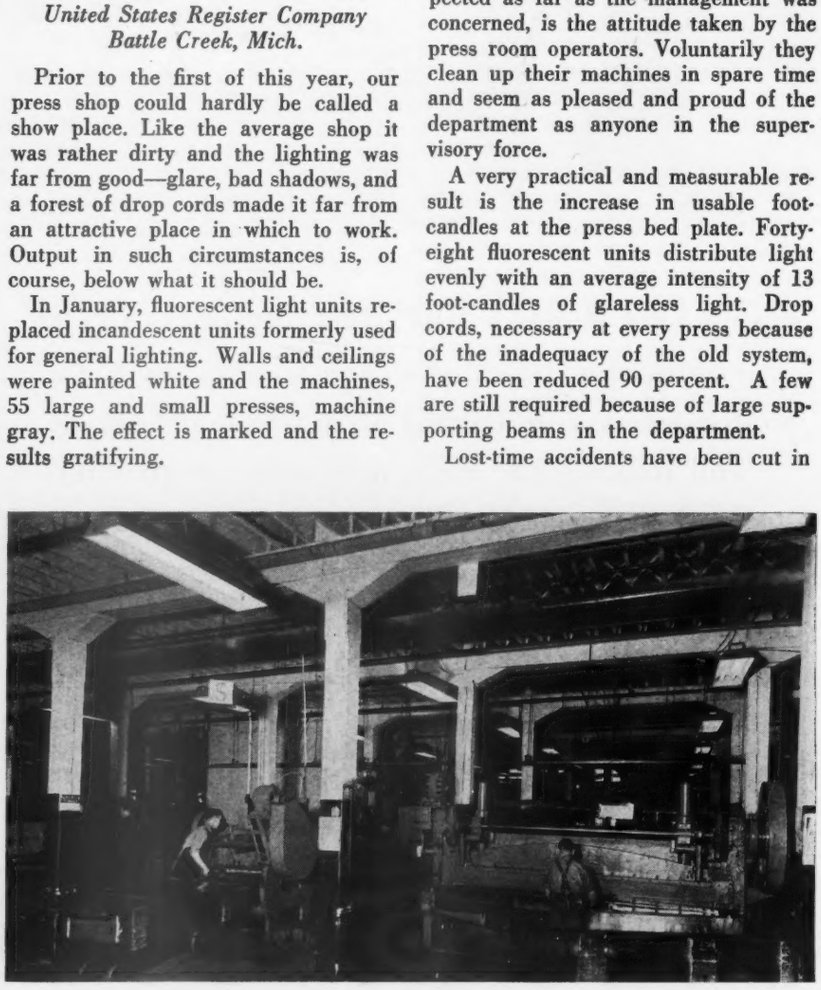
Prior to the first of this year, our press shop could hardly be called a show place. Like the average shop it was rather dirty and the lighting was far from good—glare, bad shadows, and a forest of drop cords made it far from an attractive place in which to work. Output in such circumstances is, of course, below what it should be.

In January, fluorescent light units replaced incandescent units formerly used for general lighting. Walls and ceilings were painted white and the machines, 55 large and small presses, machine gray. The effect is marked and the results gratifying.

In the first place, the shop is clean and orderly; it has a decidedly cheerful atmosphere. One aspect of this, unexpected as far as the management was concerned, is the attitude taken by the press room operators. Voluntarily they clean up their machines in spare time and seem as pleased and proud of the department as anyone in the supervisory force.

A very practical and measurable result is the increase in usable foot-candles at the press bed plate. Forty-eight fluorescent units distribute light evenly with an average intensity of 13 foot-candles of glareless light. Drop cords, necessary at every press because of the inadequacy of the old system, have been reduced 90 percent. A few are still required because of large supporting beams in the department.

Lost-time accidents have been cut in



In the shear department fluorescent lighting gives good light on dangerous operations

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CHICAGO—Contributing to employee discomfort, inefficiency; increasing time losses due to illness.

ATLANTA—Causing cold weather factory shutdowns.

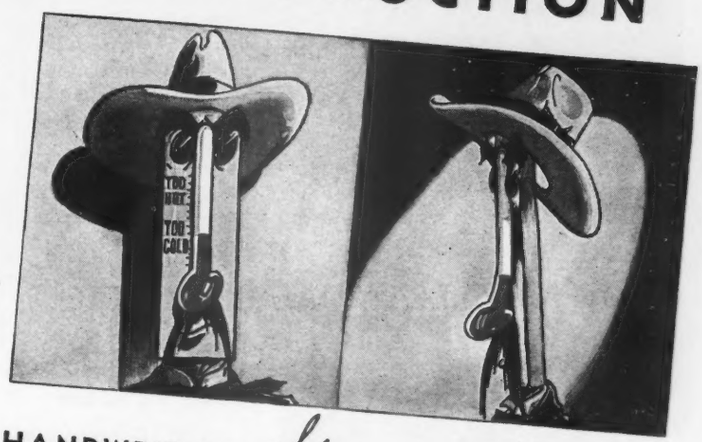
PHILADELPHIA—Delaying shipments from factories.

SEATTLE—Padding fuel and maintenance bills.

DETROIT—Theft of profits.

**ALIASES:** "Simon Degree" is an alias . . . his real name is Inadequate Heating.

**IF LOCATED, NOTIFY Modine representative, or your engineer and heating contractor AT ONCE.**

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**THE UNIT HEATER WITH THE DIRECT-FROM-PIPE SUSPENSION**

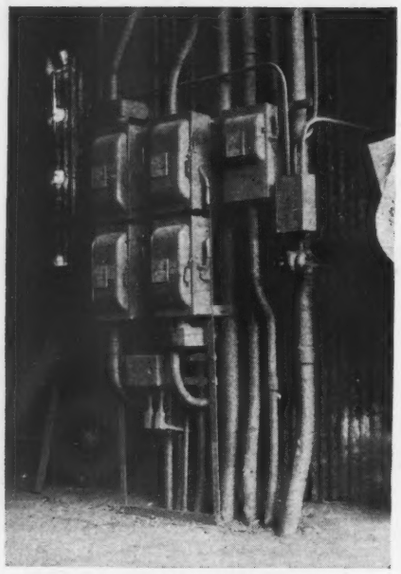
**MODINE MANUFACTURING COMPANY, 1730 RACINE ST., RACINE, WIS.**

half since this paint-up, clean-up, and light-up program has been in effect. Eye adjustments for varying light conditions, inevitable if drop lights are used, are eliminated, as is the time lag in making this adjustment. This lag is the principal cause of accidents due to poor lighting. Operators also find that it is easier to detect flaws in steel under the new lights.

Some of the things just mentioned, while very definite improvements, are intangible as far as dollars and cents are concerned. Current costs are, however, in a different category. Forty-eight fluorescent units replaced 75 incandescent units, with a saving of two-thirds in current cost. At the same time we are getting more usable light and a better distribution of it. Our product is all metal. Bad reflection from metal surfaces, and the dangerous nature of part of the operations, press work, requires lighting that fits these conditions.

The fluorescent units are hung 12 feet above the floor and 27 inches below the ceiling. The old 200-watt incandescent units were hung at a relatively low hanging height, so that the light source came within the operators' range of vision, with glare from the source as a result. With the marked reduction in watts per unit (200 to 80) glare has ceased to be a problem. The heat generated is much less of course, and this contributes to pleasanter conditions.

# ELECTRICAL UTILIZATION



## Grouping of Switches Makes Circuit Changes Easier

GILBERT LINDGREN, *Electrical Foreman*
*Hudson Valley Fuel Corporation*
*Troy, N. Y.*

There is always a strong temptation to save conduit and labor by installing switches close to the equipment which they control. Some saving will, of course, be brought about, but it is likely to be made at the expense of other, more desirable features.

As shown in the illustration, it is our practice to group switches as much as feasible, instead of scattering them all over the plant. Not only is the appearance better, when the work is neatly done, but grouping helps to save time when shooting trouble and makes it easier to change control circuits if this becomes necessary later on.

## Use Metal Sheet When Removing Rotors

S. H. COLEMAN, *Bethesda, Md.*

When dismantling large motors or generators much care must be taken to avoid damage while removing the rotor. Usually slings are suspended from a crane or hoist to lift the rotating element so that it can be moved out. Because the lengths of the rotor and stator are frequently very nearly the same it is necessary to adjust the slings several times and, while making these adjustments, to support one end of the rotor on blocking and allow the other end to rest on the laminations of the stator.

Direct contact of the rotor iron with the stator laminations is likely to result in damage to one or the other or both unless suitable precautions are taken. Perhaps the simplest and most effective method of safeguarding the machine is to slide a suitably curved, trough-shaped sheet of relatively hard steel into the bottom half circumference of the airgap clearance to serve as a buffer before attempting to move the rotor horizontally. Edges of the sheet should, of course, be seamed and rounded to prevent damage to the winding insulation.

Also, the surface on which the rotor will slide should be lightly oiled to reduce friction to a minimum. Care must be taken when applying the lubricant to remove all excess oil or grease, leaving only enough to give the surface a thin film. Too much oil or grease may do considerable harm to the rotor insulation.

To prevent the sheet itself from slipping along the stator laminations it is often desirable to tie it in place with heavy wire passed through holes in the corners at each end and fastened to convenient points on the machine base or foundation.

•

**Plant lacking an elevator got heavy equipment up to second floor by bolting an electrically driven winch to floor at head of stairway, and laying planks on the stairs for a skidway.**

•

## Stick for Hard-to-Reach Disconnect Switches

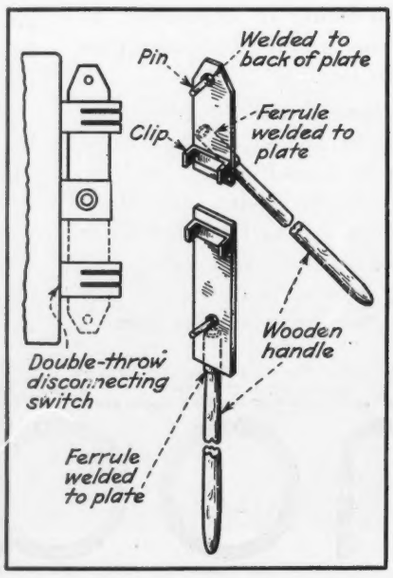
H. SAUVÉ, *Temiscaming, Que., Canada*

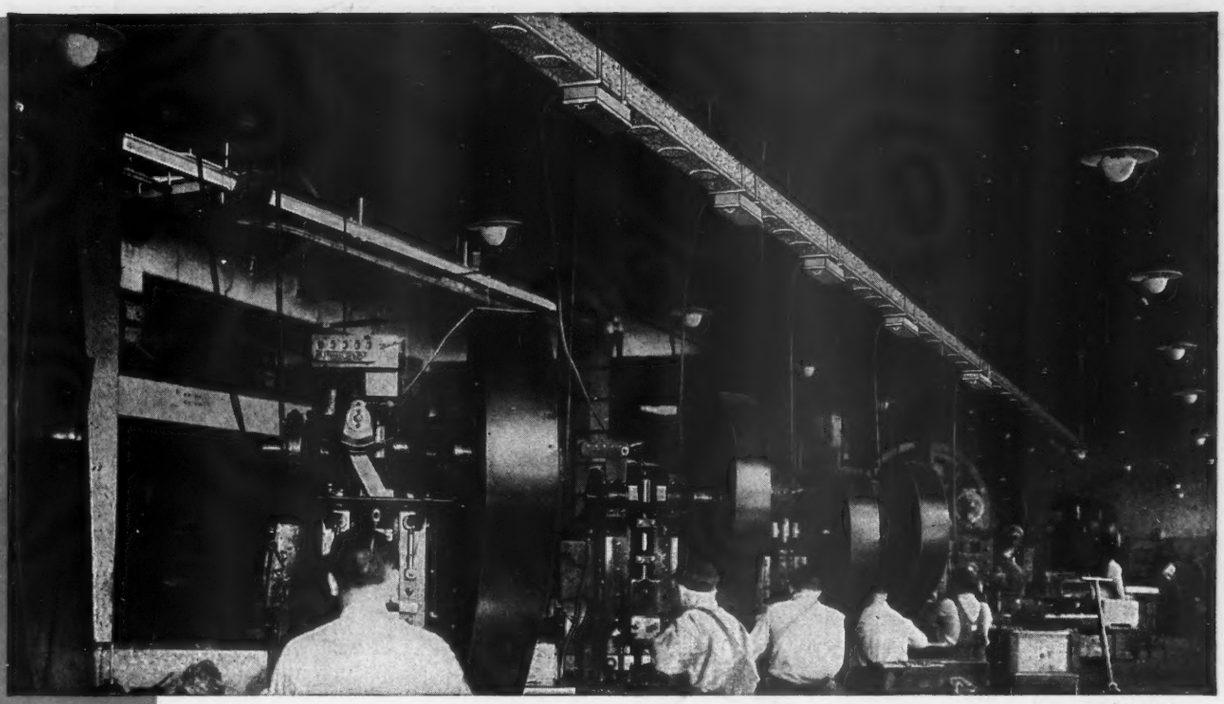
The illustration shows two forms of a special switch stick which is handy for opening disconnect switches mounted so close to an opposing wall that use of the ordinary stick is difficult or impossible because of the lack of clearance.

It will be seen that one stick consists of a flat piece of iron carrying a pin at one end which fits the hole in the outer end of the switch blade. To the other end of this flat piece is welded a clip that slips over the blade broadside, and a ferrule into which the wooden handle is fitted at an angle of about 45 degrees. This stick is intended to be used in opening switches in the up position.

The stick for switches in the down position is of the same general construction, but the respective positions of the pin and the clip are reversed, as the illustration shows.

If the stick is used on switches which do not have a barrier between phases application of cambric tape to the metal parts, except the pin and clip, will prevent the possibility of an accidental short circuit.





# Move the machine—plug in—*go!*

It's as simple as that when the plant is equipped with Plugin Ⓕⓐ Busducts. The easily-accessible outlets, conveniently spaced, make it possible to place machines at any desired location—to plug in quickly—and to commence operation without delay. With Plugin Ⓕⓐ Busducts, use Feeder Ⓕⓐ Busduct to provide ample capacity for present and future power requirements.

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Speed and efficiency will be required of you on your share of the defense job. Expert advice will be needed on your electrical installations for both power and light. . . . Centrally located, with a highly trained engineering organization in strategically located cities, the Frank Adam Electric Company is ready to consult with you, and to make quick deliveries in this emergency. You can rely on prompt and complete service, not only on Ⓕⓐ Busducts, but on other trouble-free Ⓕⓐ products — such as

**Shutlbrak Safety Switches . . . Power and Light Distribution Panelboards (Standard and Column Types) . . . Klampswitchfuz Narrow Distribution Panelboards (for floor and wall mounting) . . . and many others.**

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This is the compact, flexible and convenient method for power and light distribution. The busducts may be attached to either walls or ceilings. Flexibility is provided by suitable elbows, tees, end boxes, intermediate feed-in and feed-out boxes—all adapted to fit required space or position. Future extensions may be made readily to existing installations.

Ⓕⓐ Busducts—both Feeder and Plugin types—are made in standard 10-foot sections. Each section of the Plugin type is arranged with nine plug-in outlets on 12-inch centers. The copper bus bars (contained in enclosures of galvanized steel or aluminum) are rigidly supported at 30-inch intervals by specially designed insulators that assure proper spacing—to meet requirements of the National Electrical Code. Contact surfaces of connecting bars are silver-plated, to prevent oxidation. For 2, 3 and 4-wire feeder systems; 250 volt DC, 575 volt AC, maximum.

**Ⓕⓐ Sales-Engineers Can Help Manufacturers, Architects, Engineers and Contractors With Their Distribution Problems**

Their long experience and training are at your service—without obligation. Write for the name and address of the one nearest you. Also, for Bulletin 61, which contains complete descriptions, applications and detail drawings of Ⓕⓐ Busducts. . . . Frank Adam Electric Company, St. Louis, Mo.

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ELECTRICAL PRODUCTS for Industry

FRANK ADAM ELECTRIC CO. ST. LOUIS, MO. U.S.A.

# Electrical Control Troubles and Their Causes

(CONTINUED FROM NOVEMBER)

J. H. HOPPER

*Industrial Control Engineering Department, General Electric Company, Schenectady, N. Y.*

## Table I. Types of Control Troubles and Their Causes

**RELAYS, D. C., OVERCURRENT**

**Inverse Time**

***Slow Trip***
(*a*) Fluid too heavy
(*b*) Vent too small
(*c*) Mechanical binding
(*d*) Dirt
(*e*) Low temperature

**RELAYS, D. C., SIMPLE MAGNETIC**

***Blowout Coil Overheats***
(*a*) Overcurrent
(*b*) Wrong-sized coil
(*c*) Loose connection on stud or tip
(*d*) Tip heating (see Table II)

***Broken Flexible Shunt***
(*a*) Large number of operations
(*b*) Improper installation (check instructions)
(*c*) Extreme corrosive conditions
(*d*) Burned from arcing

***Coil Failure***
(*a*) Overvoltage
(*b*) High ambient temperature
(*c*) Wrong coil
(*d*) Moisture
(*e*) Corrosive atmosphere
(*f*) Intermittent coil energized continuously
(*g*) Holding resistor not cut in

***Failure to Drop Out***
(*a*) Mechanical binding
(*b*) Gummy substance on magnet faces
(*c*) Airgap in magnet destroyed
(*d*) Contact tip welding
(*e*) Weak tip pressure
(*f*) Voltage not removed

***Failure to Pick Up***
(*a*) Low voltage
(*b*) Coil open
(*c*) Mechanical binding
(*d*) Wrong coil
(*e*) Shorted turns
(*f*) Excessive magnet gap

***Insulation Failure***
(*a*) Moisture
(*b*) Acid fumes
(*c*) Overheating
(*d*) Dirt on surfaces
(*e*) Voltage surges
(*f*) Short circuits

***Miscellaneous Mechanical Troubles***
(*a*) Overvoltage
(b) Heavy slamming caused by: overvoltage, weak tip pressure, wrong coil
(*c*) Chattering
(*d*) Abrasive dust

**RELAYS, D. C., TIMING**

**Capacitor**

***Broken Flexible Shunt***
(*a*) Large number of operations
(*b*) Improper installation (check instructions)
(*c*) Extreme corrosive conditions
(*d*) Burned from arcing

***Coil Failure***
(*a*) Overvoltage
(*b*) High ambient temperature
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(*c*) Overheating
(*d*) Dirt on surfaces
(*e*) Voltage surges
(*f*) Short circuits

***Miscellaneous Mechanical Troubles***
(*a*) Overvoltage
(*b*) Heavy slamming caused by: overvoltage, weak tip pressure, wrong coil
(*c*) Chattering
(*d*) Abrasive dust

***Too-Long Time***
(*a*) Shim too thin
(*b*) Weak spring and tip pressure (Use brass screws for steel-backed shims)
(*c*) Gummy substance on magnet faces
(*d*) Too much capacitance
(*e*) Too much resistance

***Too-Short Time***
(*a*) Dirt in airgap
(*b*) Shim too thick
(*c*) Too much spring and tip pressure
(*d*) Misalignment
(*e*) Not enough capacitance
(*f*) Not enough resistance

**RELAYS, D. C., TIMING**

**Decay-of-flux**

***Broken Flexible Shunt***
(*a*) Large number of operations
(*b*) Improper installation (check instructions)
(*c*) Extreme corrosive conditions
(*d*) Burned from arcing

***Coil Failure***
(*a*) Overvoltage
(*b*) High ambient temperature
(*c*) Wrong coil
(*d*) Moisture
(*e*) Corrosive atmosphere
(*f*) Intermittent coil energized continuously
(*g*) Holding resistor not cut in

***Failure to Drop Out***
(*a*) Mechanical binding
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(*c*) Gummy substance on magnet faces

***Too-Short Time***
(*a*) Dirt in airgap
(*b*) Shim too thick
(*c*) Too much spring and tip pressure
(*d*) Misalignment

**RELAYS, D. C., TIMING**

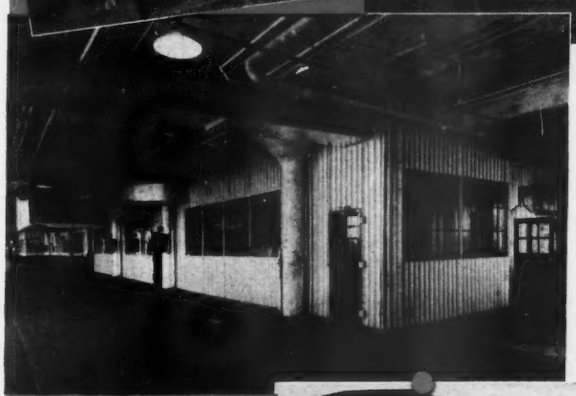
**Mechanical Escapement**

***Mechanical Wear***
(*a*) Abrasive dust
(*b*) Improper application (in general not suited for continuous cycling)

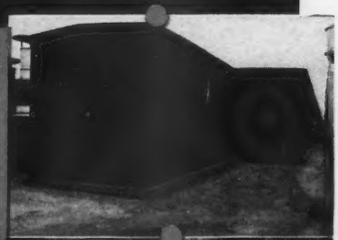
(TO BE CONTINUED)

# *Mahon* Engineered FINISHING EQUIPMENT *Handles World's Largest Finishing Production Jobs*

Right: Mahon Hydro-Filter Spray Booths installed in the Fender and Hood Finishing line in the Complete Mahon System at the Studebaker Plant, South Bend, Ind. Below: Two Mahon Hydro-Filter Spray Booths for applying the Second Color in the same system.



Above: Steel and Glass Enclosure of Air Conditioned Spray Room—part of the Complete Mahon System at Studebaker's South Bend Plant. At Right: Mahon Enamel Baking Oven installed on the roof of the plant—part of the same installation. At Right Below: Mahon Enamel Baking Oven installed inside the plant for Baking Second Color on Studebaker Hoods.



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It is not mere coincidence that the largest and most successful manufacturers, in industries where finishing is an important part of production, have turned to Mahon for the solution of their Finishing Equipment problems. Mahon engineers have earned their enviable reputation through years of research and development work on this highly specialized equipment so essential in modern production finishing . . . their eighteen years of practical experience in this field has gained for them a wealth of information which guides them in planning and designing all Finishing Systems regardless of size or type of product to be handled. You cannot afford to gamble on results when purchasing equipment which so vitally affects production costs and governs the eye appeal and saleability of your product. Call in a Mahon engineer today—consultation and study of your requirements will not place you under any obligation.

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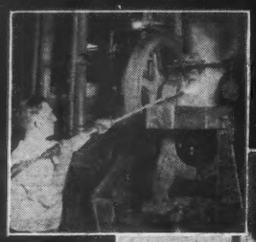

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# You Want to Know

**more about the items mentioned on this page.**
**Letters to the addresses given will bring information**

• RIGID FIBER TILE panels, over ¼ in. thick, can be put to use in washrooms and restrooms to insulate against cold, heat, and sound. They present a non-absorbent glass-like surface in a glossy or matte finish which can be painted any desired color with a single undercoat and one or two coats of enamel. The Upson Co., Lockport, N. Y.

• MAINTAINING that the Axis has missed the point by reserving little or no labor for expansion and improvement of production tools, the booklet "The Dynamics of National Strength and Security" warns us against the same mistake, and shows the part machinery plays in our national economy. Farrel-Birmingham Co., Inc., Ansonia, Conn.

• FOUR PAMPHLETS in the personnel field: "Employee Relations Policies: How to Make Them Specific," "Practical Techniques of Industrial Training," "Values of Psychology in Industrial Management," "New Responsibilities of the Personnel Executive." 50c. each. American Management Association, 330 West 42d St., New York.

• SELF-LOCKING PLASTIC LENS (rivet) is said to lock permanently into metal forms upon application of 150 degrees F. for 10 minutes. Translucent, it is available in various colors to harmonize with the product. Expanding Sign Lense Corp., 1149 Mulberry Ave., Muscatine, Iowa.

• TRANSPARENT FLOOR FINISH for wood and concrete floors, table tops, counters does threefold protective job—it's acidproof, alkaliproof, fire resistant. Comes in brown, red, green, gray. Flexrock Co., 23d and Manning Sts., Muscatine, Iowa.

• LOCKNUT has elliptically shaped spring steel retainer in head that permits the nut to be tightened up or backed part way off, long after application, without loss of gripping power. Application of nut transforms the ellipse into a circle and thus sets up strong spring pressure between bolt and retainer threads. Security Metal Products, Inc., 364 Kalamazoo Ave., Kalamazoo, Mich.

• BRINELL HARDNESS TESTER held astride conveyor by work-support rail tests wide plate at any point. Test cylinder is mounted on a carriage sliding back and forth on crossrail of the machine, and is moved across the plate by a pushbutton-controlled motor. Detroit Testing Machine Co., 9390 Grinnell Ave., Detroit.

• METALLIC BARIUM has been found to be an efficient lubricant for rotating devices operating in a vacuum. X-ray tube

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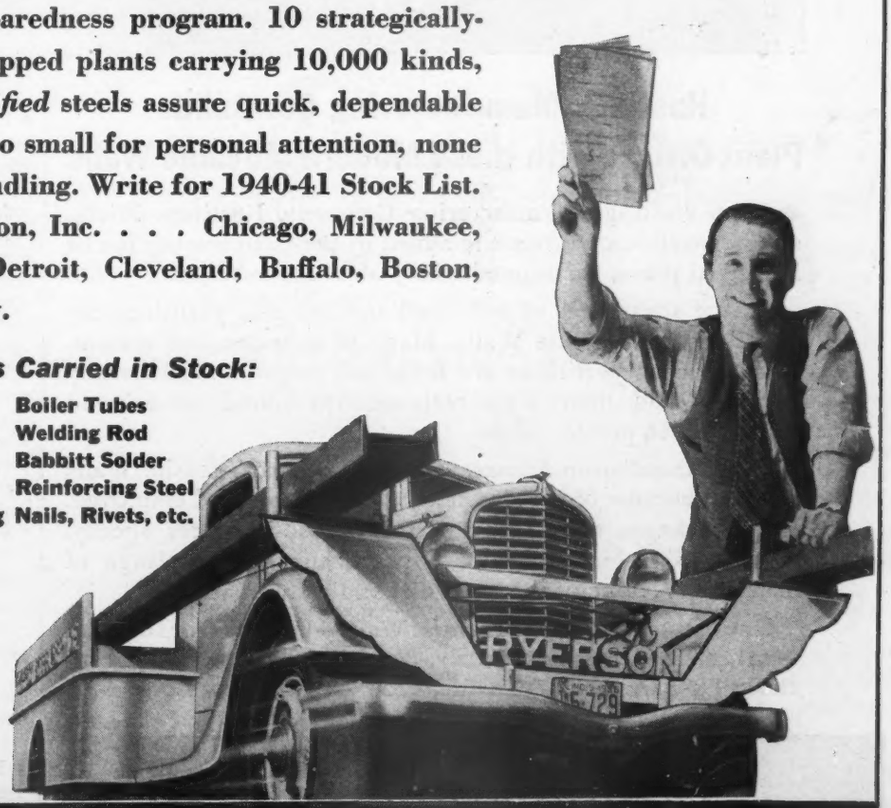


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● RUBBER-BASE COATING available in six colors for decorative and protective application on exterior or interior wood and concrete floors is said not to react chemically in the presence of alkali and moisture, to be chemical and acid resistant, lightproof and waterproof. Quick drying, it is brushed on like paint. The Truscon Laboratories, 1710 Caniff Ave., Detroit.

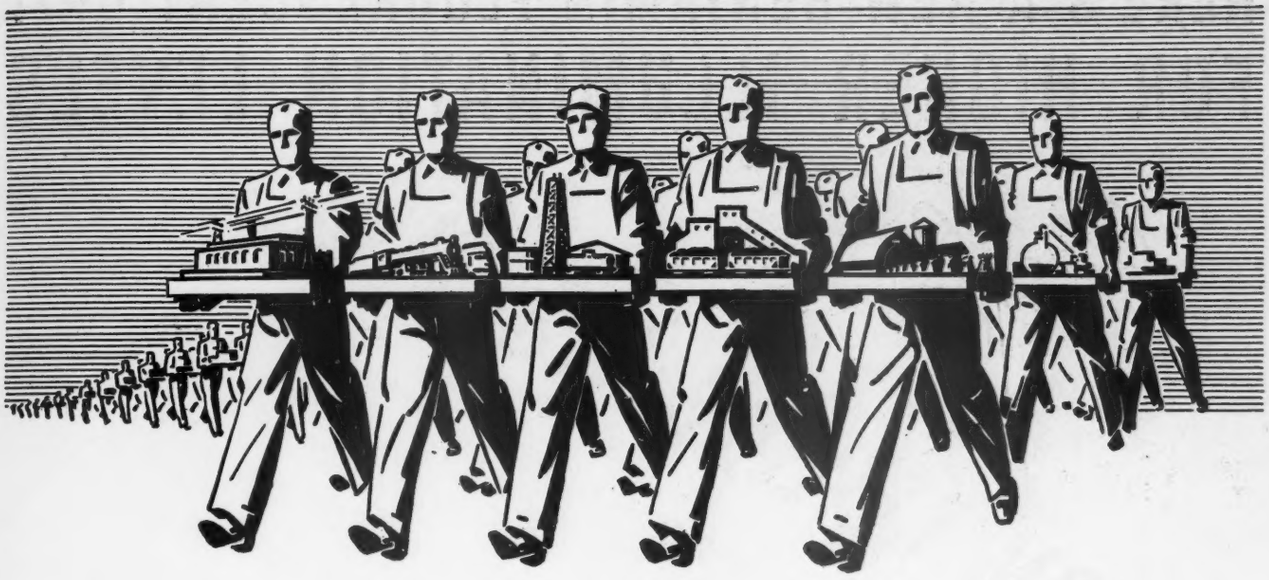
● ALUMINUM-CASEIN PAINT, quick drying, not only primes and seals damp or dry plaster, wallboard, cement, brick, wood, and other porous surfaces, but also effectively covers dark-colored surfaces and stains to permit painting over with light colors. Applied to bituminous waterproofing coatings it acts as an anti-bleeder. The Brytenall Co., Liberty St. at Hudson River, Ossining, N. Y.

● PLASTIC PACKING has tape back reinforcement vulcanized to its outer surface that makes the packing sufficiently pliable to be bent around small-diameter rods and shafts without fracturing or cracking, or formed into small-inside-diameter rings. Available in six styles for centrifugal and rotary services; ¼ to 1-in. sizes. The Crane Packing Co., 1800 Cuyler Ave., Chicago.

● THREE VOCATIONAL achievement tests—in machine shop, electricity, and industrial mathematics—reveal testees technical information. Package containing 20 copies of any of the tests and a copy of a manual of directions, $1. Division of Education and Applied Psychology, Purdue University, Lafayette, Ind.

● ANNUAL SCHEDULE of shows and exhibits for 1941 lists approximately 350—name of exhibit, date, location, sponsor, name and address of permanent secretary or show manager. $5 to non-members of the Exhibitors Advisory Council, 120 Greenwich St., New York.

● RUST PREVENTIVES have high degree of adhesion to metals, wetting out surfaces rapidly and making a "non-tacky" unbroken film impervious to atmospheric conditions. Series includes liquid and grease-type products, drying, non-drying, semi-drying, waxy, and soluble. E. F. Houghton & Co., Third, American, and Somerset Sts., Philadelphia.



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*And*

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### Brings you THREE New ADVANCES in Fluorescent Lighting

Benjamin RLM "Stream-Liter 60" units utilizing two of the new 100-watt Mazda Fluorescent Lamps bring these new advances to the field of fluorescent lighting: 1. Higher levels of lighting to meet present day requirements of many industrial operations; 2. Extension of the use of efficient, "cool" daylight fluorescent lighting to include locations requiring higher mounting and wider spacing of units; 3. Ceiling Illumination to reduce brightness contrasts, increase seeing efficiency and improve room appearance.

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At the conventional spacing and mounting height higher lighting levels approaching the goal of 50 footcandles of general illumination may be attained. The contour of the reflector, spacing of the lamps, and porcelain enamel reflecting surface, all combine to provide adequate distribution of light on both horizontal and vertical surfaces. Adequate protection against glare is provided by a shielding angle of 14 degrees and closed-end reflector construction.

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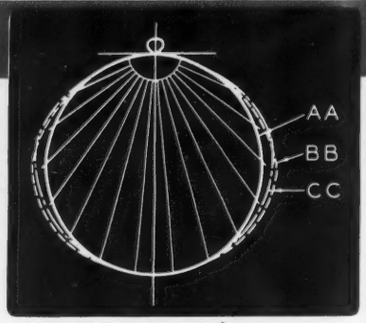
An important feature of this new unit is the provision for ceiling illumination. A series of apertures is located in the top of the reflector over each lamp. These openings permit 2% of the light output to pass upward to relieve contrast between the lighted room areas and the ceiling.

#### Built to RLM Specifications

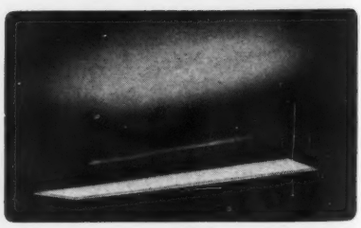
Additional features important to the attainment of highest lighting efficiency at lowest cost are: Porcelain enamel reflecting surfaces with a 79% reflection factor; light output efficiency of 75% or more; correction for power factor and flicker. The unit bears Underwriters' Inspection Label and the RLM LABEL which is a warranty of compliance with rigid RLM Specifications. It is certified by Benjamin to comply with all recognized electrical, illumination and mechanical standards. The unit is also available without apertures.

#### Send for Complete Details

Write today for your FREE copies of Data Sheets on the Benjamin "Stream-Liter 60" and other Benjamin Fluorescent Lighting units. Mail coupon or address Benjamin Electric Manufacturing Co., Dept. N, DesPlaines, Illinois.




*This light distribution curve shows the wide area lighted and the uniform ceiling illumination provided by the aperture design with the new Benjamin "Stream-Liter 60".*



*Apertures provide ceiling illumination which reduces brightness contrasts, increases seeing efficiency and improves room appearance.*

BENJAMIN ELECTRIC MFG. CO.
Dept. N, DesPlaines, Illinois

Gentlemen: Please send me complete information on the Benjamin "Stream-Liter 60" and other Benjamin Fluorescent units. This does not obligate me in any way.

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*Firm*_____

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*Distributed Exclusively Through Electrical Wholesalers*

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Throughout America, manufacturers and plant executives are finding that Century Motors, properly selected and applied, have much to do with keeping production steady and in holding production costs to a minimum.

Obsolete motor drives and motors that do not accurately meet the demands of the driven machine are actually enemies of your cost department, for they penalize production and run up unnecessary maintenance and operating expense.

Century Motors are allies of industry. The wide diversification of the Century Motor line makes it an easy matter to obtain the *right* motor for the job—one with operating characteristics necessary for the most efficient machine performance. Sizes range from fractional to 600 horsepower.

Let your nearest Century Motor Specialist give you full information on the advantages of the various types of Century Motors for the many kinds of industrial applications. Because his recommendations may cut *your* production costs, it will pay you to call him in.

**CENTURY ELECTRIC COMPANY**
1806 Pine Street St. Louis, Missouri
*Offices and Stock Points in Principal Cities.*

Century MOTORS

***One of the Largest Exclusive Motor Manufacturers in the World***

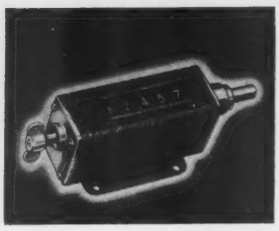
# Make a "Counter Attack" on COSTS

## WITH
## Veeder-Root Counting Devices

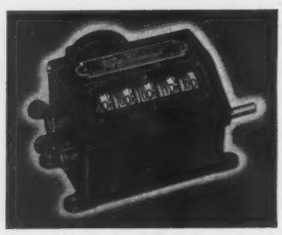
If production costs are getting out of line and moving in on you . . . *blast them at their bases*, and set them back in their places with systematic control founded on work-capacity records supplied by Veeder-Root Counting and Computing Devices.

Every machine, process and operator in your plant and office can be geared to the top-potential of efficiency . . . with the help of Veeder-Root Devices that can "count anything on earth," in any terms or units of performance. Start your "counter-attack" *today*. Call in a Veeder-Root engineer.

**IN THE PLANT**

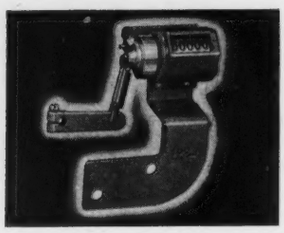


**For High Speed Work:** This High Speed Reset Counter runs at 8,000 counts per minute in direct-drive type; 2,000 counts in revolution type.

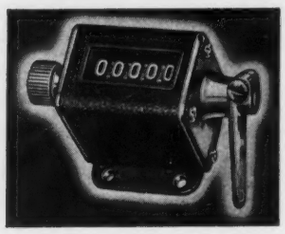


**Controls Machine Runs:** Predetermining Counter prevents over-runs and shortages on winders, fast automatics, running up to 2,500 r. p. m.

**IN THE OFFICE**



**Accounting & Typing:** This Production Computator records keystrokes on typewriters and accounting machines, provides a fair basis for wages.



**For Office and Light Production Machines:** Small Reset Counters count strokes or revolutions. May be furnished with totalizing register.

# Veeder-Root Inc.

**HARTFORD, CONNECTICUT**

**OFFICES IN** Boston, Chicago, Cincinnati, Cleveland, Detroit, Greenville, S. C., Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis, San Francisco, Montreal, Buenos Aires, Mexico City, London, Paris, Tokio, Shanghai, Melbourne. **IN ENGLAND:** Veeder-Root Ltd., Croydon, Surrey. **IN CANADA:** Veeder-Root of Canada, Ltd., Montreal

AUTOMATIC
5 TON CAPACITY

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# THE NEW 1941 AUTOMATIC 5 TON CAPACITY LOW AND HIGH LIFT PLATFORM TRUCKS TAKE THEIR PLACES AS *New* LEADERS FOR *"Speedier"* SKID TRANSPORTATION SYSTEMS

**COMPLETELY NEW FROM CONTROL TO BUMPER**

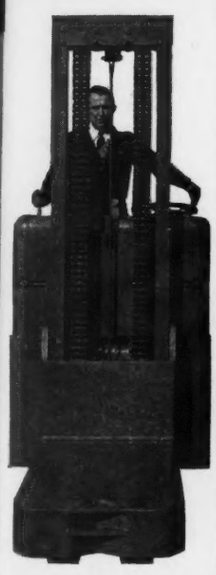
Model LO-5 Low-Lift
Standard Platform Dimensions
60" Long, 26" Wide, 11" High
5" Lift

Model TLO-5 High-Lift
Standard Platform Dimensions
60" Long, 26¼" Wide,
11" High, 60" Lift

TO MEET the growing demand for "Speedier" 5 TON Skid transportation and stacking in Automotive, Machine Tool and Metal Working Industries, "AUTOMATIC" offers you these new heavy-duty low and high lift platform trucks.

They are ***completely new*** in every detail of "AUTOMATIC" Engineering—Electrical Control—Construction Styling and Performance Efficiency.

In no other competitive truck of this type will you find ALL the All-Star "AUTOMATIC" features for Greatest overall efficiency—Exceptional smooth controls—Utmost ease and flexibility in maneuvering—Top speed performance with ultimate safety to operator, materials and mechanism—Get the full facts at once concerning these two new trucks—Use the coupon below.



***Note***
**EXCEPTIONALLY CLEAR OPERATING VISION**

## ALL-STAR "AUTOMATIC" FEATURES

★ **SPEED-O-MATIC DRIVE CONTROL**

Smooth safe top speed acceleration and deceleration with positive NO-PLUG forward and reverse travel action. Full magnetic contactor drive and lift control.

★ **EQUA-POISED DRIVE UNIT**

Highest efficiency "AUTOMATIC" standardized spiral bevel and spur gear drive. Torque-flow mounted in frame eliminates travel chatter and side sway.

★ **DYNA-TROL LIFT UNIT**

Roller chain hoist with "AUTOMATIC" Triple-spur gear transmission precision mounted in horizontal split housing. New TRI-POINT mounting in frame for perfect alignment.

★ **FLANGE-MOUNTED MOTORS**

Heavy-duty "AUTOMATIC" industrial type Drive motors fan-cooled for top-travel performance.

★ **ECONO- MAINTENANCE**

Over 50 friction—free bearings used—Fully enclosed dirt-proof lubrication—with ample lubrication reservoirs. Simplified electro-mechanical controls—Balanced mechanical unit mountings—all contribute to low maintenance factor.

★ **STRAIGHT-LINE CHASSIS STYLING**

From Control to Bumper—*New* Utility Styling with straight-line frame—Rigid deep sectional construction for increased strength, stability and safety. Well ventilated fully accessible battery compartment.

★ **BALANCED LOW CENTER OF GRAVITY**

Every inch of space utilized but ample accessibility for all parts. Both trucks inches smaller than previous models requiring minimum operating space.

★ **FRICTION-FREE SHOCKLESS STEERING**

Self-compensating steering connections ball-bearing mounted with *perma-sealed* dirt proof casings.

★ **LOAD-BALANCED TRAIL AXLE**

Alloy steel construction—Triple sealed wheel bearings—Center-pivoted knuckle steer pins assure minimum tire drag or wear.

**AUTOMATIC TRANSPORTATION COMPANY**
DIV. OF THE YALE & TOWNE MFG. CO.
39 W. 87th St. CHICAGO, ILL.
Gentlemen: Please send details on trucks
Model LO-5 Low Lift ☐ Model TLO-5 High Lift ☐
Name_____
Address_____
Company_____
City_____ State_____

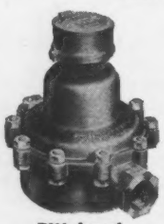
WHEN YOU BUY TRUCKS · · Buy "AUTOMATIC"

*Increase*
Steam Plant
EFFICIENCY
with METERS

The amount of water evaporated compared with the fuel burned, gives the measure of boiler efficiency. When the boiler feed water, the condensate steam returns and the oil or gas fuel are measured by meter, an accurate record and check on efficiency is available.

Pittsburgh Equitable is the only company building a complete line of meters for measuring gas, oil and water. The installation of EMCO Gas or Pittsburgh Oil meters on fuel lines will quickly show fuel consumption over any given period. Pittsburgh Cold Water Meters are the solution to the measurement of boiler feed water consumption, and Pittsburgh Hot Water Meters are being used extensively to gauge and control steam consumption through accurate measurement of the condensate at every point where it is gathered. The combination of these two types of meters furnishes complete information on steam consumption and loss as well as providing a means of properly allocating steam charges throughout the plant.

Pittsburgh
Fuel Oil Meter



Pittsburgh
Hot Water Meter

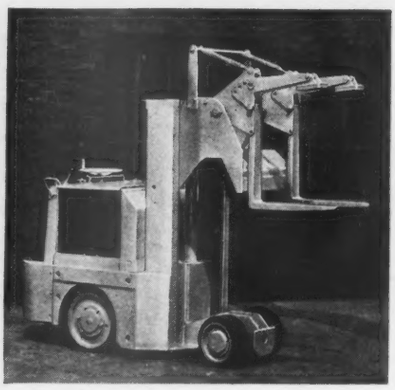
EMCO Gas Meter

PITTSBURGH EQUITABLE
METER COMPANY
403 LEXINGTON AVENUE
PITTSBURGH, PENNA.

# What's New in Equipment

## Ford Truck

Model A-2440 fork-type truck with automatic clamps for handling tin plate and loose stacks of sheet metal features 2-wheel



drive, 4-wheel steer, horizontal wheel-type steering control. It is powered through heavy-duty, double-reduction drive-axle. The travel controller, a double-unit mechanical-contactor type, provides 4 speeds in either direction and has separate manual control handles for travel direction and speed selection. Hoist mechanism is hydraulic. Capacity—4,000 lb., loads up to 36 in. in length. The Mercury Mfg. Co., 4044 South Halsted St., Chicago.

## Conductivity Bridge

Type RC-IB general-purpose bridge for electrolyte conductivity measurement from 2 ohms to 2 megohms is equipped with a vacuum-tube oscillator to supply the bridge source at 1,000 cycles. Self-contained, it operates on 100-135 volts, 50-60 cycles. Companion model operates on 220 volts, 25 cycles. Used for determining concentration of electrolytic titractions, testing distilled water and other liquids. Industrial Instruments, Inc., 155 Culver Ave., Jersey City, N. J.

## Diesel Engines and Diesel Electric Plants

Diesel engines, 36-40 hp., 4 cylinders, are electrically started. Many parts are interchangeable with 9-hp. single-cylinder vertical engine. They are of enbloc construction with replaceable wet-type cylinder liners. Built-in gear-driven water-circulating pump, thermostatic jacket-water control and water-cooled exhaust manifold assure cooling by radiator, tank, tower, or marine pump. Cylinder head contains combustion chamber, intake and exhaust valves, and the fuel injection nozzle. Crankcase is ventilated with forced-feed lubrication to cam and crankshaft bearings and forced-flood lubrication of gears. Flywheel, clutch, 30-kva. generator or marine gears may be attached to either end of the 4-cylinder engine so that they may be installed in matched "right" and "left" units. The diesel engines are made in 4-40 hp. and the Dieselectric plants in 3-30 kva. Witte Engine Works, Kansas City, Mo.

## Enclosed Contactor

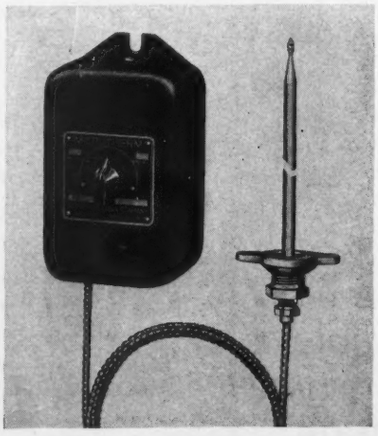
Type Dn multi-pole contactor, available in ratings up to 10 amp., 600 volts, a.c., may contain up to 8 poles in any combination of normally open and normally closed contacts. Enclosure is made of black enamel sheet steel and has a deep drawn snap cover. General shape of the enclosure conforms to that used on the standard line of line-starters. Westinghouse Electric & Mfg. Co., East Pittsburgh.

## Alloy Steels

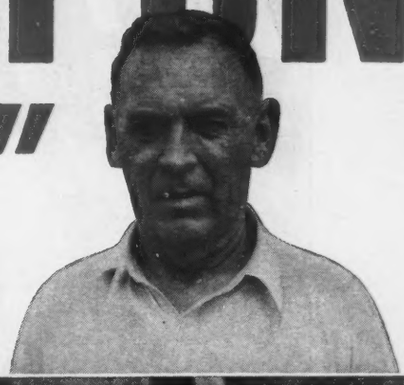
Line of alloy steels for the aircraft industry has been extended to include heat-treated and cold-drawn annealed bar products. S.A.E. steels of the various alloy series are supplied in bar form to meet physical requirements for such parts as bolts, U-bolts, studs, and other stress parts. Jessop Steel Co., 527 Green St., Washington, Pa.

## Remote-Bulb Control

Remote-bulb thermostat for proportioning control is said to find use where requirements call for a motor-operated valve or damper to be positioned accurately and quickly in accordance with load variations—for dryers, hot water tanks, air con-



# "I'M TOUGH ON MOTORS!"



**— Says E. H. Humberstone, Superintendent, Marble Cliff Quarries Co., Columbus, Ohio. And He Adds — "That's Why I Use Allis-Chalmers Lo-Maintenance Motors in Our Plants — 187 of Them!"**

*Another true case history from the Allis-Chalmers files that proves* **"IT PAYS TO BUY THE EQUIPMENT THAT PAYS FOR ITSELF!"**

ONE OF 187 ALLIS-CHALMERS LO-Maintenance Motors in use in the Marble Cliff Quarries Co. plants, this 10-hp motor drives a double-deck screen . . . was installed in 1925. Service costs on this motor in fifteen years to date have been ***zero!***

A STONE process plant is a good place to get the low-down on motor performance. Abrasive stone dust fills the air . . . loads are heavy . . . and costs are closely watched!

That's how conditions are at the Marble Cliff Quarries Company plant, Columbus, Ohio . . . conditions that can wreck an ordinary motor in a few months. And because Marble Cliff Quarries want uninterrupted service... long motor life . . . low power costs . . . they've equipped their plants with 187 Lo-Maintenance Motors . . . practically a 100% representation for Allis-Chalmers!

But read what E. H. Humberstone, superintendent, has to say —

"We make flux for the steel industry, and that means we must keep close watch on our costs. Often our motors run 24 hours a day, for months at a time. Yes, I'm tough on motors — have to be! But for years we've given first choice to Lo-Maintenance Motors because we have found they give longer service with less servicing."

## Your Best Buy is Lo-Maintenance!

What Mr. Humberstone says is being backed up by hundreds of other production men . . . men who want the low-cost, money-saving service Lo-Maintenance Motors give them . . . in reduced power costs . . . in longer life.

For in Allis-Chalmers Lo-Maintenance Motors you get performance that's more than just a rated horsepower. It's performance based on full-measure construction — indestructible rotor . . . distortionless stator . . . high carbon steel frame . . . no skimp or stint anywhere. These, plus all the other Lo-Maintenance features, make it the best motor buy for you.

For full information on how these motors can help you cut your power costs, see the trained engineer in the district office near you, or write Allis-Chalmers, Milwaukee. A 1294

*Over 90 Years of Engineering Superiority Work for You When You Specify Allis-Chalmers!*

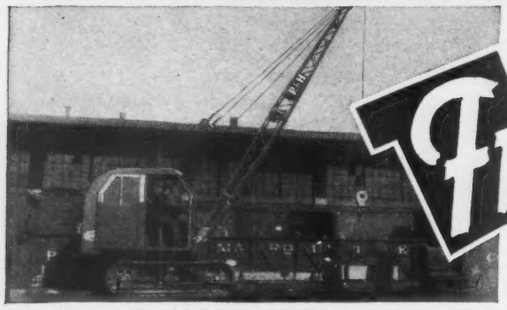
ALLIS-CHALMERS

MILWAUKEE · WISCONSIN

● The speed and mobility of P&H Crawler Cranes, and the flexibility of their service, are making these machines as valuable to industry as P&H Overhead Electric Cranes.

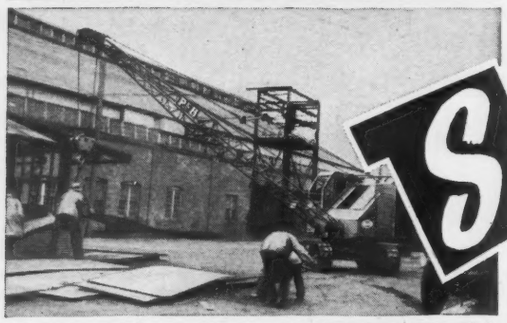
SCRAP

● P&H Crawler Crane handling scrap with magnet. Machine is easily and quickly converted for hook, sling or clamshell service.



FREIGHT

● Loading and unloading gondolas—jobs are speeded up by the easy maneuvering of a P&H.



SHEETS

● Handling raw or finished materials. Smooth control permits accurate placing, stacking, etc.

COAL

● Unloading and transferring coal is done more efficiently when a fast-working P&H gets the assignment.

● P&H Crawler Cranes are built in a wide range of sizes and lifting capacities. If you have a yard or warehouse handling problem, write to us!

*General Offices:* 4525 West National Avenue, Milwaukee, Wisconsin

**HARNISCHFEGER**
**CORPORATION**
EXCAVATORS • ELECTRIC CRANES • ARC WELDERS P&H HOISTS • WELDING ELECTRODES • MOTORS

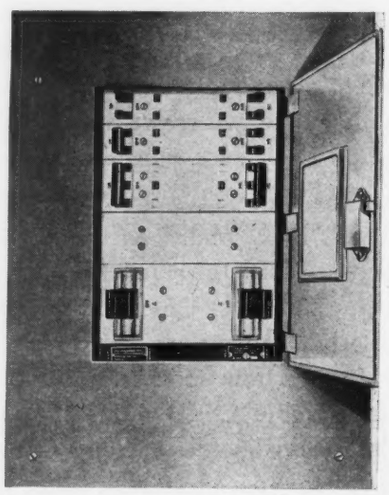

ditioners. Remote bulb and bellows assembly are hydraulically formed, volume of liquid and conducting surfaces are balanced to give minimum ambient temperature effect, bulb is furnished with mounting flange suitable for immersion or duct mounting. Also available for 2-position control with snap-acting contacts and for floating control. Barber-Colman Co., Rockford, Ill.

### Indirect Steam Trap

Type BSDE, having large capacity, is suitable for pressures up to 175 lb. per sq. inch. It consists of the company's standard inverted bucket steam trap of small size coupled to a special diaphragm valve in the condensate discharge line. The valve is normally closed. When condensate opens the discharge valve of the pilot trap, pressure reaches the large diaphragm of the main valve and opens it wide. It remains open as long as condensate flows and shuts when the trap closes. Available in sizes ½ to 2½ in. inclusive. Sarco Co., Inc., 183 Madison Ave., New York.

### Distribution Panelboards

MH Multi-Breaker power panels provide circuit-breaker protection for power and light distribution and are suitable for use on ungrounded systems. They are dead



front with 15-100 amp. capacity common trip branch breakers, 115-230 volts a.c. single phase and 3 phase. Boxes are standardized—20 in. wide, 5¾ in. deep. The units are interchangeable and can be arranged in various combinations. The Trumbull Electric Mfg. Co., Plainville, Conn.

### Aluminum Ladder

Light-gage aluminum alloy straight ladder is said to weigh 1 lb. per ft., to have a tensile strength of 48,000 lb. per sq. inch. Its easy portability makes it useful in oiling machinery and making general repairs, building maintenance, sign painting. It also is of value in airplane use. Its side rails and ¾-in. round rungs can safely support the heaviest workman, it is

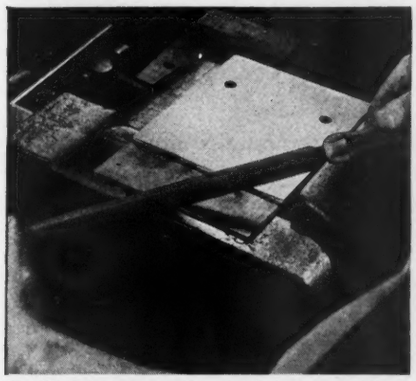
# GEARED UP FOR ANY FILING REQUIREMENT

**TYPE "A" ALUMINUM FILE.** Special teeth prevent "chatter." Made for rapid filing of aluminum, aluminum-alloy, other ductile-metal castings, bars or sheets. Flat and Half-round shapes, 6" to 16".

**LONG ANGLE LATHE FILE.** Teeth cut for clean-shearing and self-clearing effect; to prevent drag or scoring; for fast, smooth finishing under light pressure. Mill, 10" to 16"; Flat, 6" to 16".

**BRASS FILE.** Short "upcut" teeth prevent file running off the work; long "overcut" breaks up filings and keeps file clear of chips. Available in Flat and Half-round shapes, 6" to 12".

**DIE-CAST FILE.** File designed mainly for finishing die-cast objects consisting of combinations of aluminum, zinc, magnesium, etc. Extra-strong teeth on edges. Mill and Half-round, 6" to 14".



**STAINLESS STEEL FILE.** Special-shape teeth to withstand the high abrasive action of the tough chromium carbides and nickel alloy. Available in same shapes and sizes as general purpose files.

**FOUNDRY FILE.** Extra-rugged teeth and heavy-set edges – to resist "shelling" and breaking out. For fast metal removal on rough castings. Flat, Half-round, Round and Square shapes, 8" to 18".

SPEED, accuracy and work-volume are the industrial watchwords of today. Metals and their alloyed offspring are manifold. Products and production methods present widely varying conditions.

The combinations of factors are so many and varied that it is not enough to know which type of tool or device to use, but what *special design in the tool* will lead to the best action or results in a given instance or on a particular job.

This is particularly true of files. Nicholson has found the multiplicity of filing problems big enough to command the exclusive study and attention of specialists.

Deep-rooted in this policy, Nicholson makes nothing else . . . lists more than 3000 kinds, sizes and cuts of files . . . has become the largest file manufacturer in the world . . . and, through well-equipped facilities for fast production, special orders, or consulting service, is *geared up for any filing requirement.*

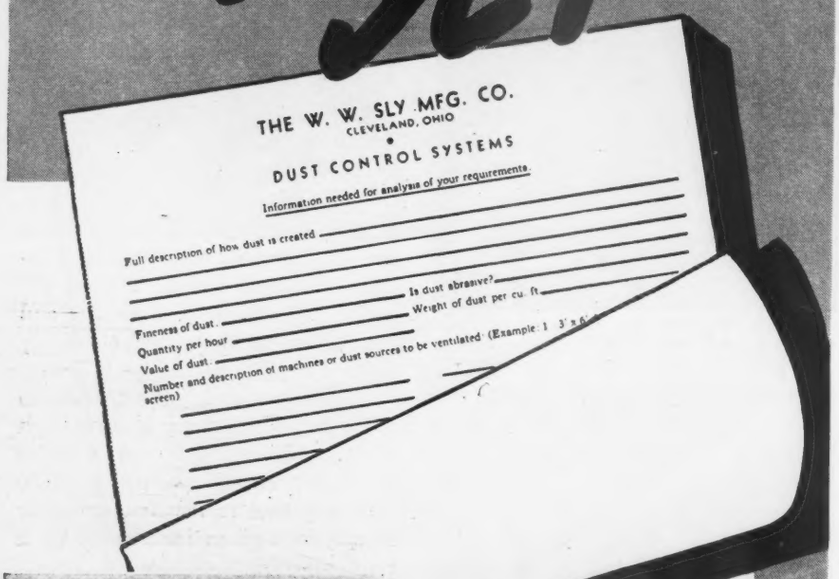
**NICHOLSON FILE CO., PROVIDENCE, R. I., U. S. A.**
*(Also Canadian Plant, Port Hope, Ont.)*

• *A few of the many Nicholson and Black Diamond special-purpose files are action-illustrated here. TECHNICAL BULLETINS on the design, features and application of these, as well as Shear-tooth, Lead Float, Aluminum Rasp, etc., are available through your mill-supply house or direct from us.*

NICHOLSON U.S.A. MADE IN U.S.A.

**NICHOLSON FILES FOR EVERY PURPOSE**

# How you get BETTER DUST CONTROL BY SLY


THE W. W. SLY MFG. CO.
CLEVELAND, OHIO
DUST CONTROL SYSTEMS
Information needed for analysis of your requirements.
Full description of how dust is created
Fineness of dust
Is dust abrasive?
Quantity per hour
Weight of dust per cu. ft.
Value of dust
Number and description of machines or dust sources to be ventilated (Example: 1 3' x 6'
screen)

*Sly Dust Filter installations are not expensive and they are an economic asset with definite profits and many other intangible advantages.*

*This Data Blank will be sent you. Fill it out and we will make recommendations. No obligation. We will also send our book on "Industrial Dust Control", containing a wealth of information.*

**During the past 40 years we have supplied dust control systems for over 100 kinds of dust in 56 industries.**

**Every situation we found different from every other.**

**Only by adequate analysis of the problem were we able to design and produce dust control systems that fulfilled all the requirements of each job 100%. This is the basis of the Sly Plan—getting answers to certain fundamental questions, carefully studying the data, then building accordingly.**

**We shall gladly study your problem and suggest the solution—without any obligation on your part. Write today.**

**THE W. W. SLY MFG. CO.**

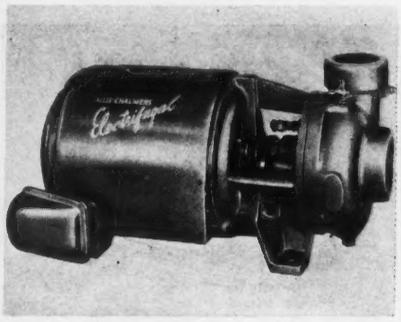
**Branch Offices in Principal Cities**

**4755 Train Avenue** **Cleveland, Ohio**


claimed. Supplied in sizes up to 16 in. wide and 20 ft. long. May be fitted with safety shoes. Aluminum Ladder Co., 122 Adams St., Tarentum, Pa.

### Centrifugal Pump

The Electrifugal pump is an all-in-one centrifugal pump designed as a complete pump and motor unit on one shaft and one housing. The feet are cast integral with the housing and bracket and extend under



the entire unit. The motor is splashproof and is available in sizes 1-10 hp. at 3,500 r.p.m. and from ¾ to 7½ hp. at 1,750 r.p.m. for heads up to 160 feet. Totally enclosed, fan-cooled motors, and explosion-proof motors are also available in the Electrifugal type. For normal service, the pump is built with cast-iron casing, bronze fitted. Can be made all iron, all bronze, all stainless steel or of other special metals. Allis-Chalmers Mfg. Co., Milwaukee.

### Conduit Fittings

Form 37. Interior design features smooth curves to eliminate abrasion instead of sharply cut right-angle turns that crack and cut insulation and cause sharp kinks in wire or cables. Radii of the conduit hub bell-mouth curves are in accordance with the wire manufacturers' performance specification mandrel, it is said. This design also makes it easier to pull the wires through. Made of Adalloy (high-strength cast iron), available in sizes up to 2 in., larger sizes up to 4 in. on notice. The Adalet Mfg. Co., 1448 East 49th St., Cleveland.

### Intercommunicating System

Twinphone Master station and selector for executive's desk contacts six or more substations located in outlying offices of assistants and department heads to provide 2-way conversation and thus lighten telephone switchboard work. Remote control feature enables employees to converse through Twinphone from any part of the room without approaching the substation, it is said. Executone, Inc., 415 Lexington Ave., New York.

### Metal-Fume Respirator

For protection against fumes of metals such as generated when burning, pouring, or molding lead, cadmium, zinc. Construction features: Filter area more than double

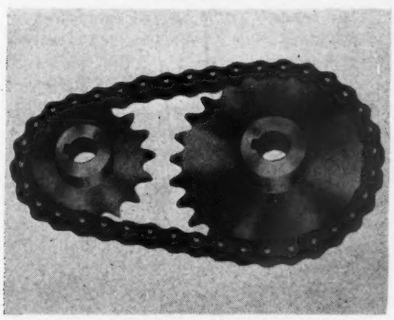
that of regular Comfo dust filters, aluminum filter containers to keep out grease and dirt, all-rubber facepiece, U. S. Army type exhalation valve. Filters can be changed when necessary, rubber facepiece and aluminum filter containers may be washed and disinfected. May be used by men engaged in such operations as welding, burning, or riveting steel coated with lead paint; melting and pouring brass and bronze; welding and cutting galvanized iron. Mine Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh.

### Block and Pipe Insulation

L-W Superex insulation material is for use in industrial furnaces, ovens, kilns, roasters, regenerators, high temperature mains, flues, stacks where the insulation is subjected to temperatures between 600 and 1,500 deg. F. Of the molded diatomaceous silica type, the insulation is light in weight —20 lb. per cu.ft., is available in block and pipe form, and in sectional form for piping headers within the same temperature range. Blocks furnished 3, 6, 9, and 12 in. wide in standard lengths of 18 and 36 in., and in thickness from 1-4 inches. Curved blocks also available. Pipe insulation is supplied to fit standard pipe sizes in section or segments 3 ft. long and up to 2½ in. thick. Johns-Manville, 22 East 40th St., New York.

### Eight-Mm. Roller Chain

Dimensions: 0.315 in. pitch, rollers 0.197 in. diameter by 0.125 in. width. Average ultimate strength is rated at 1,100 pounds. Said to have 192 individual parts in each

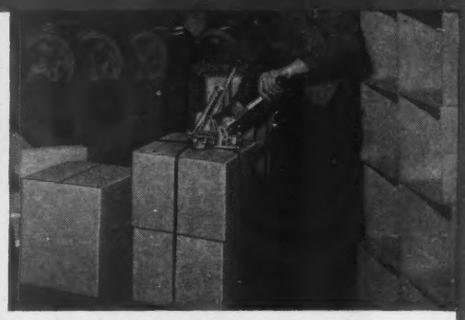


foot of chain assembled to a total length tolerance of plus 0.0156 in. minus 0.000. Made for use where heavier bulkier chains won't do, for power transmission at high speeds, for driving of light-weight machinery, for timing mechanisms, for precision instruments and equipment. Diamond Chain & Mfg. Co., Indianapolis, Ind.

### Payroll Calculator

Designed to reveal at a glance the total amount due any wage earner in regular pay and in overtime pay based on the requirement of time-and-a-half for all hours worked over 40 a week. Contains 261 individual wage-rate tables covering every period of service from ¼ to 60 hours. Wage rates from 30c to $1.50 are in ½-cent steps; from $1.50 to $2 in 2½-cent steps. Wages are shown for ¼, ½, ¾, and full-hour


# Doc. Steelstrap CUTS CUSTOMER-COMPLAINTS PROVIDES PROTECTION FOR PULLEYS



*OTHER ADVANTAGES* are also assured by the Acme Steelstrap Process—storage space is saved. Inventory handling is facilitated. And the problem of different sized shipments is easily solved by the telescoping feature of the pack.

*FORMERLY,* the products made by this leading manufacturer of pulleys were shipped in packages which did not provide full protection to the product.

*NOW,* by using Acme Steelstrap in combination with corrugated cartons, dirt is kept out—the dangers of scratching, marring and other damage are eliminated. And customer goodwill is protected. Acme Steelstrap makes the new pack practical and economical.

★

*FOR EVERY TYPE OF PRODUCT,* handling, packing and shipping can be simplified and made more economical by the Acme Steelstrap Process. Acme engineers have cooperated with container manufacturers and shippers in every industry in eliminating unnecessary costs, in speeding up shipments and insuring customer goodwill. One or more of the 429 Acme Strapping tools and accessories can help you "streamline" your packing and shipping process. Mail the coupon for details.

## HOW TO REDUCE YOUR SHIPPING COSTS

No matter how different *your* packing and shipping methods may be, the odds are in your favor that additional savings in time, effort and costs can be made. Perhaps one or more of the 429 specially designed Acme tools and accessories can be used to obtain lower freight and material costs or eliminate pilferage. Perhaps unnecessary motion and excess fatigue can be avoided. An Acme engineer will be glad to suggest the tools and arrangement which will assure maximum speed and economy.

See how other leading manufacturers have taken advantage of the Acme Steelstrap Process and Acme Unit-Load Process (for carload and l.c.l. shippers). Be sure that you are not carrying an unnecessary cost burden. Send for your copy of "Stopping Profit Leaks Beyond the Production Line." ACME STEEL COMPANY, 2831 Archer Avenue, Chicago, Illinois. Branches and Sales Offices in Principal Cities.

ACME Steelstrap PROCESS
FOR MAKING SHIPMENTS "BOUND TO GET THERE"

ACME STEEL COMPANY
2831 Archer Avenue, Chicago, Illinois

☐ Have an Acme engineer call.

☐ Mail a free copy of "Stopping Profit Leaks" which illustrates the application of the Acme Process in every industry.

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WORK ALL OVER THE YARD
• The speed and mobility of P&H Crawler Cranes, and the flexibility of their service, are making these machines as valuable to industry as P&H Overhead Electric Cranes.
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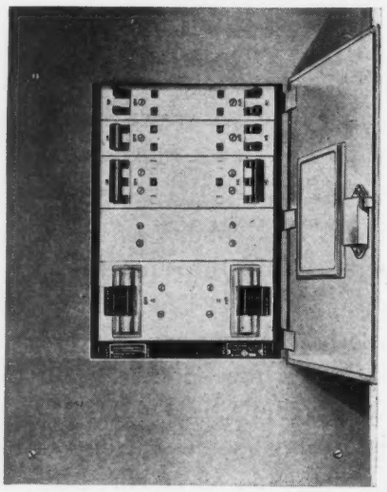
ditioners. Remote bulb and bellows assembly are hydraulically formed, volume of liquid and conducting surfaces are balanced to give minimum ambient temperature effect, bulb is furnished with mounting flange suitable for immersion or duct mounting. Also available for 2-position control with snap-acting contacts and for floating control. Barber-Colman Co., Rockford, Ill.

### Indirect Steam Trap

Type BSDE, having large capacity, is suitable for pressures up to 175 lb. per sq. inch. It consists of the company's standard inverted bucket steam trap of small size coupled to a special diaphragm valve in the condensate discharge line. The valve is normally closed. When condensate opens the discharge valve of the pilot trap, pressure reaches the large diaphragm of the main valve and opens it wide. It remains open as long as condensate flows and shuts when the trap closes. Available in sizes ½ to 2½ in. inclusive. Sarco Co., Inc., 183 Madison Ave., New York.

### Distribution Panelboards

MH Multi-Breaker power panels provide circuit-breaker protection for power and light distribution and are suitable for use on ungrounded systems. They are dead



front with 15-100 amp. capacity common trip branch breakers, 115-230 volts a.c. single phase and 3 phase. Boxes are standardized—20 in. wide, 5¾ in. deep. The units are interchangeable and can be arranged in various combinations. The Trumbull Electric Mfg. Co., Plainville, Conn.

### Aluminum Ladder

Light-gage aluminum alloy straight ladder is said to weigh 1 lb. per ft., to have a tensile strength of 48,000 lb. per sq. inch. Its easy portability makes it useful in oiling machinery and making general repairs, building maintenance, sign painting. It also is of value in airplane use. Its side rails and ¾-in. round rungs can safely support the heaviest workman, it is

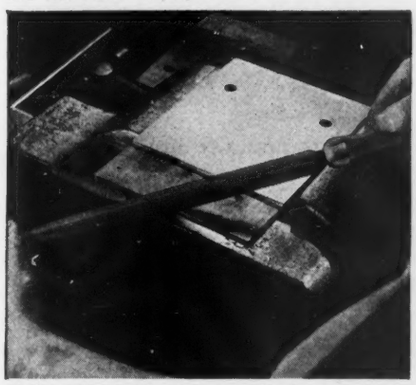
# GEARED UP FOR ANY FILING REQUIREMENT

**TYPE "A" ALUMINUM FILE.** Special teeth prevent "chatter." Made for rapid filing of aluminum, aluminum-alloy, other ductile-metal castings, bars or sheets. Flat and Half-round shapes, 6" to 16".

**LONG ANGLE LATHE FILE.** Teeth cut for clean-shearing and self-clearing effect; to prevent drag or scoring; for fast, smooth finishing under light pressure. Mill, 10" to 16"; Flat, 6" to 16".

**BRASS FILE.** Short "upcut" teeth prevent file running off the work; long "overcut" breaks up filings and keeps file clear of chips. Available in Flat and Half-round shapes, 6" to 12".

**DIE-CAST FILE.** File designed mainly for finishing die-cast objects consisting of combinations of aluminum, zinc, magnesium, etc. Extra-strong teeth on edges. Mill and Half-round, 6" to 14".



**STAINLESS STEEL FILE.** Special-shape teeth to withstand the high abrasive action of the tough chromium carbides and nickel alloy. Available in same shapes and sizes as general purpose files.

**FOUNDRY FILE.** Extra-rugged teeth and heavy-set edges — to resist "shelling" and breaking out. For fast metal removal on rough castings. Flat, Half-round, Round and Square shapes, 8" to 18".

SPEED, accuracy and work-volume are the industrial watchwords of today. Metals and their alloyed offspring are manifold. Products and production methods present widely varying conditions.

The combinations of factors are so many and varied that it is not enough to know which type of tool or device to use, but what *special design in the tool* will lead to the best action or results in a given instance or on a particular job.

This is particularly true of files. Nicholson has found the multiplicity of filing problems big enough to command the exclusive study and attention of specialists.

Deep-rooted in this policy, Nicholson makes nothing else . . . lists more than 3000 kinds, sizes and cuts of files . . . has become the largest file manufacturer in the world . . . and, through well-equipped facilities for fast production, special orders, or consulting service, is *geared up for any filing requirement.*

**NICHOLSON FILE CO., PROVIDENCE, R. I., U. S. A.**
*(Also Canadian Plant, Port Hope, Ont.)*

• *A few of the many Nicholson and Black Diamond special-purpose files are action-illustrated here. TECHNICAL BULLETINS on the design, features and application of these, as well as Shear-tooth, Lead Float, Aluminum Rasp, etc., are available through your mill-supply house or direct from us.*

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**NICHOLSON FILES FOR EVERY PURPOSE**

# How you get BETTER DUST CONTROL BY SLY

THE W. W. SLY MFG. CO.
CLEVELAND, OHIO

DUST CONTROL SYSTEMS

Information needed for analysis of your requirements.

Full description of how dust is created

Fineness of dust

Is dust abrasive?

Quantity per hour

Weight of dust per cu. ft.

Value of dust

Number and description of machines or dust sources to be ventilated. (Example: 1 3' x 6'
screen)

*Sly Dust Filter installations are not expensive and they are an economic asset with definite profits and many other intangible advantages.*

*This Data Blank will be sent you. Fill it out and we will make recommendations. No obligation. We will also send our book on "Industrial Dust Control", containing a wealth of information.*

**During the past 40 years we have supplied dust control systems for over 100 kinds of dust in 56 industries.**

**Every situation we found different from every other.**

**Only by adequate analysis of the problem were we able to design and produce dust control systems that fulfilled all the requirements of each job 100%. This is the basis of the Sly Plan—getting answers to certain fundamental questions, carefully studying the data, then building accordingly.**

**We shall gladly study your problem and suggest the solution—without any obligation on your part. Write today.**

**THE W. W. SLY MFG. CO.**

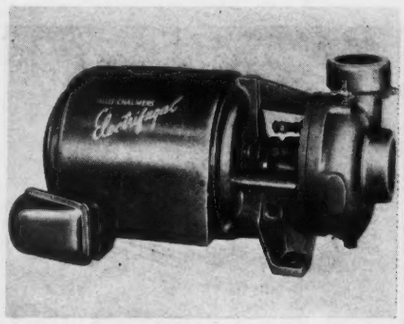
**Branch Offices in Principal Cities**

**4755 Train Avenue** **Cleveland, Ohio**


claimed. Supplied in sizes up to 16 in. wide and 20 ft. long. May be fitted with safety shoes. Aluminum Ladder Co., 122 Adams St., Tarentum, Pa.

### Centrifugal Pump

The Electrifugal pump is an all-in-one centrifugal pump designed as a complete pump and motor unit on one shaft and one housing. The feet are cast integral with the housing and bracket and extend under



the entire unit. The motor is splashproof and is available in sizes 1-10 hp. at 3,500 r.p.m. and from ¾ to 7½ hp. at 1,750 r.p.m. for heads up to 160 feet. Totally enclosed, fan-cooled motors, and explosion-proof motors are also available in the Electrifugal type. For normal service, the pump is built with cast-iron casing, bronze fitted. Can be made all iron, all bronze, all stainless steel or of other special metals. Allis-Chalmers Mfg. Co., Milwaukee.

### Conduit Fittings

Form 37. Interior design features smooth curves to eliminate abrasion instead of sharply cut right-angle turns that crack and cut insulation and cause sharp kinks in wire or cables. Radii of the conduit hub bell-mouth curves are in accordance with the wire manufacturers' performance specification mandrel, it is said. This design also makes it easier to pull the wires through. Made of Adalloy (high-strength cast iron), available in sizes up to 2 in., larger sizes up to 4 in. on notice. The Adalet Mfg. Co., 1448 East 49th St., Cleveland.

### Intercommunicating System

Twinphone Master station and selector for executive's desk contacts six or more substations located in outlying offices of assistants and department heads to provide 2-way conversation and thus lighten telephone switchboard work. Remote control feature enables employees to converse through Twinphone from any part of the room without approaching the substation, it is said. Executone, Inc., 415 Lexington Ave., New York.

### Metal-Fume Respirator

For protection against fumes of metals such as generated when burning, pouring, or molding lead, cadmium, zinc. Construction features: Filter area more than double

# Ready AFTER DECEMBER 18th

## Two RLM 60" Mazda FLUORESCENT Twin-Lamp LIGHTING UNITS

*Showing how the use of apertures in RLM 60" Fluorescent Diffuser Unit provides ceiling illumination that is uniform and free from shadows and bright striations.*

● These latest RLM approved Fluorescent Units for the new 100-watt Type F Mazda Lamps when installed at the conventional ten foot spacing and mounting heights provide the higher levels of illumination demanded by present day industrial requirements. Moreover, adequate levels of lighting are now attainable in locations requiring higher mounting and wider spacing. Essential features of these two new units are: Shielding angle of 14 degrees; Porcelain Enamel reflecting surface for diffusion and durability with reflection factor of 79%; light output efficiency of 75%; in addition, the apertures of the diffuser unit direct 2% of the light into the upper zone; corrected for power factor and flicker with ballast equipment approved by E.T.L. and Underwriters' Laboratories.

Insist on RLM Labeled 60" Fluorescent Units. This RLM Label is your assurance of their compliance with rigid specifications and periodic inspections...has nation-wide recognition as a warranty of uniformity and quality. Only units bearing this label are RLM approved.

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# FASTER TOOL CRIB SERVICE WITH *Half* THE TOOLS . . . . *thru*

# McCASKEY TOOL CONTROL

Speedier service at crib windows with a fifty percent reduction in tool inventory has resulted from the use of McCaskey Tool Control in the tool room of Harley-Davidson Motor Company, world-famous Milwaukee manufacturer of motor cycles, Package Trucks and Servi-Cars.

PRODUCTION engineers Gordon M. Davidson and William S. Hansen, highspot the outstanding advantages and savings shown by analysis of the first year of McCaskey Control:

"We know definitely what tools are required for operation of the department. As a result, the crib inventory has been cut 50%, even though some items have been added when the need has been indicated.

"The Crib is much better organized. There now is a place for every tool and no time is wasted hunting tools either in the crib or on the production floor. Tools are systematically inspected when returned and immediately reconditioned, if necessary.

"The withdrawal and return of tools is much faster than with brass checks. Our employees would object to returning to the check system. The many results of McCaskey Control actually have exceeded our greatest expectations."

Prevent your cribs from becoming production bottlenecks. You *know* what tools you need with McCaskey, no more no less; you *know* where every tool is, can locate them in a few seconds; no lost time for machines and men; no loss or theft and less breakage; easily installed in the busiest crib; surprisingly inexpensive. Speed-up your production by modernizing your tool service Write today for facts.

McCASKEY REGISTER COMPANY, ALLIANCE, OHIO

**McCASKEY INDUSTRIAL CONTROLS**

PRODUCTION • INVENTORY • MAINTENANCE • TOOLS • COSTS • PAYROLL

that of regular Comfo dust filters, aluminum filter containers to keep out grease and dirt, all-rubber facepiece, U. S. Army type exhalation valve. Filters can be changed when necessary, rubber facepiece and aluminum filter containers may be washed and disinfected. May be used by men engaged in such operations as welding, burning, or riveting steel coated with lead paint; melting and pouring brass and bronze; welding and cutting galvanized iron. Mine Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh.

### Block and Pipe Insulation

L-W Superex insulation material is for use in industrial furnaces, ovens, kilns, roasters, regenerators, high temperature mains, flues, stacks where the insulation is subjected to temperatures between 600 and 1,500 deg. F. Of the molded diatomaceous silica type, the insulation is light in weight —20 lb. per cu.ft., is available in block and pipe form, and in sectional form for piping headers within the same temperature range. Blocks furnished 3, 6, 9, and 12 in. wide in standard lengths of 18 and 36 in., and in thickness from 1-4 inches. Curved blocks also available. Pipe insulation is supplied to fit standard pipe sizes in section or segments 3 ft. long and up to 2½ in. thick. Johns-Manville, 22 East 40th St., New York.

### Eight-Mm. Roller Chain

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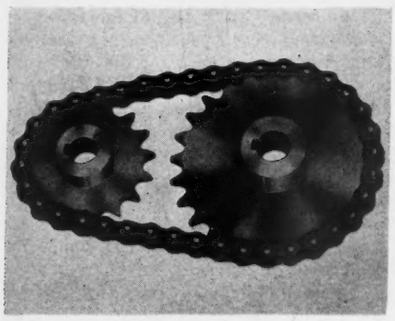

foot of chain assembled to a total length tolerance of plus 0.0156 in. minus 0.000. Made for use where heavier bulkier chains won't do, for power transmission at high speeds, for driving of light-weight machinery, for timing mechanisms, for precision instruments and equipment. Diamond Chain & Mfg. Co., Indianapolis, Ind.

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*OTHER ADVANTAGES* are also assured by the Acme Steelstrap Process—storage space is saved. Inventory handling is facilitated. And the problem of different sized shipments is easily solved by the telescoping feature of the pack.

*FORMERLY*, the products made by this leading manufacturer of pulleys were shipped in packages which did not provide full protection to the product.

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☐ Have an Acme engineer call.

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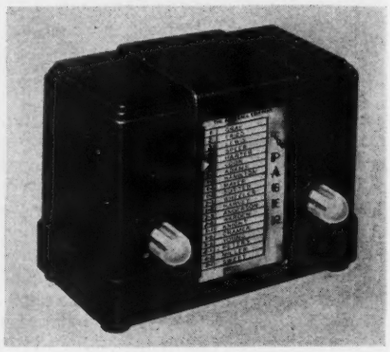
*City*.....*State*.....

periods. The calculator is a visible card record book. The cards are printed in black and green and turn on metal hinges. Visible margins have a transparent protective covering. Acme Visible Records. Inc., 8 South Michigan Ave., Chicago.

### Paging System

The Pager unit, a code-sending station, transmits codes to locate from 1-20 individuals. Numbers are assigned to persons




wanted most frequently, the Pager is dialed to the party wanted, an audible code is then transmitted to all departments simultaneously. The signals may be musical chimes, bells, gongs. The Autocall Co., 112 Thomas Ave., Shelby, Ohio.

### Automatic Air Filter

Designed to replace present Multi-Panel and Double-Duty filters. The casing has been designed so that either Armored screen panels of the Multi-Panel filter or die-stamped louver panels of the Double-Duty filter can be used for the filter curtain so that there is now one standard filter where before there were two. This interchangeability is made possible by a newly designed curtain channel guide adjustable to any thickness of filter curtain. Drive motors are ½ hp.—a.c., capacitor type, 110 or 220 volts, 25, 50, or 60 cycles, single phase; or d.c. compound wound, 110 or 220 volts—and may be operated directly from the lighting service. The a.c. motors may be operated from one phase of a 2- or 3-phase circuit if single phase is not available. American Air Filter Co., Inc., First & Central Ave., Louisville, Ky.

### Steam and Water Mixer

Injection-type steam and water mixing unit makes possible a supply of 3,000 gal. of hot water per hour at any desired controlled temperature, it is said. Three connections for installation: One to the cold water line, another to the high-pressure (50-150 lb.) steam line, third for the hot water outlet. Measures 2½ ft. long by 2 ft. high and weighs less than 100 pounds. May be used where indirect heaters have been used to provide hot water for washrooms, sterilizers, industrial processes, for general cleaning as a service water-heater booster, for high-temperature service. Avail-

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CLEANS
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LEDGES
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RECLAIMS
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METALS
RUBBER
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GRIT
LINT
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It's "HELLO—GOODBYE" to dirt *when Spencer Vacuum comes in*

Regardless of the kind of dirt or where it is, Spencer Vacuum Tools will reach it and remove it instantly and forever. This system is a unique combination of high powered vacuum, light weight specially designed vacuum tools for every purpose, and separators and dirt receptacles of ample capacity to contain the refuse from any kind of an industrial operation.

SPENCER VACUUM PROTECTS AS IT SAVES

**IT PROTECTS** your men, your machines, materials and finished product. It reduces fire and explosion hazards and is recommended in the majority of codes for the prevention of fire and explosions.

**IT SAVES** time in large areas, cuts overhead cleaning costs 50% to 100%, eliminates rejects due to dust, and reclaims valuable materials (see list above).

**"VACUUM CLEANING FOR INDUSTRY"**—the new Spencer book contains 20 pages of data on the use and savings and a description of Spencer Systems ranging from the ¾ HP portable to the 100 HP stationary system which is piped just like compressed air, throughout the plant.

Ask for Bulletin No. 120-F.

182-D

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CENTRAL AND PORTABLE VACUUM CLEANING SYSTEMS
THE SPENCER TURBINE COMPANY, HARTFORD, CONN.

# MAGNETIC MOTOR STARTERS

## ARROW—H&H

No. 1, 2 and 3 Sizes
1½ H. P. - 110 V.
single phase
to 50 H. P.-550 V.
polyphase

You build into your machines every tested aid to *assured performance.* Make sure of it at the starting-point! — the motor starting SWITCH. The starters illustrated here give tested protection to motor, machine and operator. 50 years of fine switchmaking culminate here, — in soundness of principle, precision of mechanism, convenience of operation.

The line provides for local *and* remote control. Local control starters may be operated from remote points through Push Button Stations or other master devices, as well as by the push buttons at the starter. This permits handy control of mechanical linkages involving separate functions or sequences of machine operations.

*FEATURES:* ACROSS-THE-LINE TYPE (TYPE MC); HAND RE-SET, LOCAL OR REMOTE CONTROL. UNDER-VOLTAGE RELEASE; OVERLOAD PROTECTION BY INTERCHANGEABLE THERMAL HEATERS OF THE BI-METALLIC TYPE, ACCURATELY CALIBRATED FOR ANY SIZE MOTOR WITHIN RATED CAPACITY. SINGLE OR POLYPHASE: 110, 220, 440, 550 VOLTS; 25, 40, 50, 60 CYCLES; OTHER FREQUENCIES IF SPECIFIED. STANDARD HOUSING: STEEL BOX, MACHINE GRAY FINISH. ALSO WEATHERPROOF AND SPECIAL HOUSINGS FOR HAZARDOUS LOCATIONS.

Catalog No. 8-M brings descriptions and data you'll want. And please make use of our Free Engineering Service for practical arrangements of ARROW-H & H *Standard* Units to meet your *special* problems in motor control.

INDUSTRIAL CONTROL DIVISION
THE ARROW-HART & HEGEMAN ELECTRIC COMPANY, HARTFORD, CONN., U. S. A.

A SAVING AT EVERY TURN

Save Money

Whether for light, medium or heavy duty use, Darnell Casters and Wheels are built to take punishment.

nearly 4000 Models of Casters and Wheels

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- Reduce Floor Wear to a minimum.
- Eliminate wracking of equipment.
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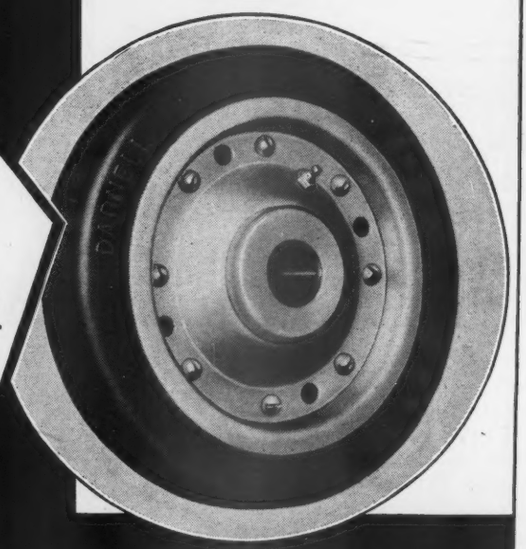
Describes nearly 4000 different types of casters and wheels—a type for every industrial use.



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DARNELL CORP. OF CANADA, LTD., TORONTO, ONT., CAN.

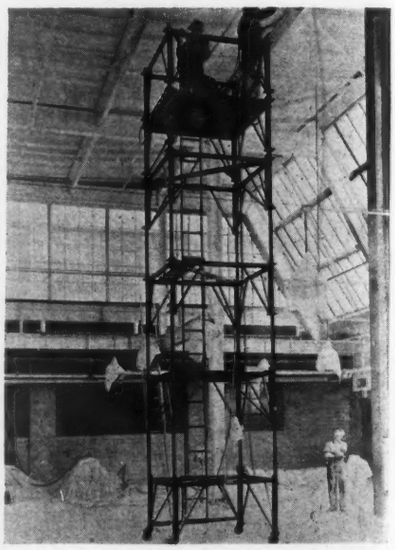
able in ½, ¾, or 1-in. steam connections with any one of 4 selected adjustable water-temperature ranges. Features: Easily accessible clean-out plugs, temperature and pressure relief valves, single-seated steam control valve, bronze construction, provision for tempering inlet water and recirculating mixer water to reduce noise and lime deposit. The W. J. O'Brien Co., 205 Harrison St., Syracuse, N. Y.

### Bronze Globe Valve

The valve has a full-plug-type seat and disk designed for throttling services on high-temperature and high-pressure steam lines. Also suitable for use on high-pressure lines carrying boiler scales and other gritty substances. Body is made of hard bronze, disk and seat of heat-treated stainless steel, 500 Brinell hardness, stem is high-strength wear-resisting bronze. Reading-Pratt & Cady Division, American Chain & Cable Co., Inc., Reading. Pa.

### Safety Steel Scaffold

For use by maintenance men, painters, electricians, the Quik-Set Safety Scaffold consists of square-section tubular-steel-brace and corner-post units with electrically welded parts designed for quick erection



in straight line, in corners, around rectangular or circular constructions, bridging, over constructions with truss units. Also provided are steel floor sections, detachable ladders, adjustment posts for erection on uneven surfaces, brackets for catwalks and for holding material, casters for use on interior work, skip hoist for lifting materials. Tools, bolts, screws, and clamps are not used, it is said. Mechanical Handling Systems, Inc., 4600 Nancy Ave., Detroit.

### D.C. Crane Limit Stop

Main-circuit crane safety-limit stop to prevent overtravel of the crane hook when hoisting operates by a counter-weighted lever and a suspended reset weight. Features claimed: Quick make and quick break

# If you want to speed up your business and lead the rest

## then find out today what G-E Fluorescent Lighting can do for you —

THERE are two ways to speed up production schedules in your plant . . . regardless of the kind of plant it is. One is to train new employees and buy new equipment and enlarge your plant.

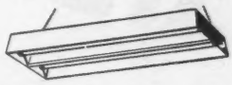
The other way—while you're waiting to do all this—is to put in G-E Fluorescent Lighting!

Does that sound too simple? It *is* simple. People can see faster and *work* more efficiently when they have *plenty of light.* And with G-E Fluorescent Lighting you can *have* more light than you ever had before! Light that in color, quality, and coolness, in over-all diffusion, is the closest practical approach to actual daylight ever devised!

When can you get it? Now, tomorrow! Your G-E MAZDA lamp distributor can show you a full line of approved fluorescent fixtures, ready to hang up and use with G-E MAZDA F (Fluorescent) lamps. And that's vitally important. If you want the full benefits of General Electric lighting knowledge and leadership, be sure you actually *get* G-E MAZDA lamps. They assure maximum light output for current consumed and they're made to stay brighter longer! If you want to speed up *your* business, phone your G-E lamp man or your power company *today,* or mail the coupon for the inside story of the most exciting new kind of light developed in the past 61 years!

### COMPLETE FIXTURES NOW AVAILABLE

Industrial unit, 100 watts, using two 40-watt, 48-inch G-E MAZDA F lamps.



Industrial unit, 75 watts, using two 30-watt, 36-inch G-E MAZDA F lamps.

Industrial unit, 100 watts, using two 40-watt, 48-inch G-E MAZDA F lamps.

This label identifies Fleur-O-Lier fixtures, made by over 35 experienced manufacturers, and certified by Electrical Testing Laboratories as meeting 50 specifications set up by MAZDA lamp manufacturers, when equipped with ballasts and starters certified by E. T. L.

The certified fluorescent fixtures shown above are only a few of the many complete fixtures now available through G-E MAZDA lamp distributors. G. E. does not make fixtures but is glad to recommend Fleur-O-Liers and RLM Industrial Fixtures.

### PRICES REDUCED ON G-E MAZDA LAMPS

On June 1, 1940, General Electric announced sweeping price reductions on Fluorescent and many other types of G-E MAZDA lamps for home and business, including Mercury Vapor and Silvered Bowl MAZDA lamps.

**G-E MAZDA F** *lamps are recommended for use only with equipment providing good power factor, such as Fleur-O-Liers, or RLM Industrial Fixtures.*

### A WORD OF ADVICE

*Be sure you get G-E MAZDA F lamps, made to assure maximum light output and stay brighter longer. Remember, unless they have the G-E monogram they're not G-E MAZDA lamps!*

*Illustration Copyright 1940 Esquire-Coronet, Inc.*

**G-E MAZDA LAMPS**

**GENERAL ELECTRIC**

General Electric Company, Dept. 166-F-L
Nela Park, Cleveland, Ohio
Please mail, without obligation, complete information about G-E Fluorescent lighting for my plant.

*Name* _____

*Name of firm* _____

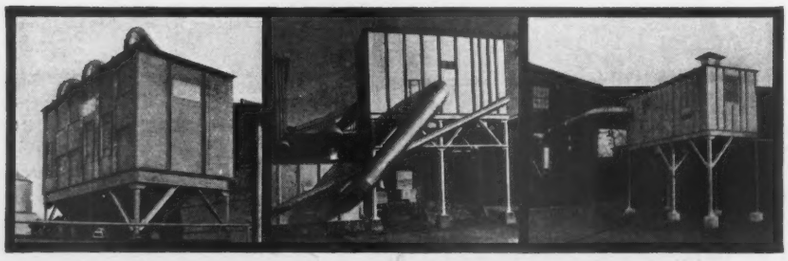
*Address* _____

● Many manufacturing processes give off dusts that are not only destructively ABRASIVE in their scattered contacts throughout industry's plants but are CORROSIVE as well—a double hazard to equipment and the products being made.

Why tolerate this expensive nuisance when it can be so easily and inexpensively controlled by Pangborn all metal, cloth screen, Dust Collectors?

More than 4,950 Pangborn installations are controlling dust today; efficiently, safely, and economically. Pangborn engineers can do a good job for you, too. Tribute to the Dust Hog ends when they are called in upon your problems.

Whether your needs are big or small—it will pay you to "get in touch with Pangborn." Write for information today.



PANGBORN

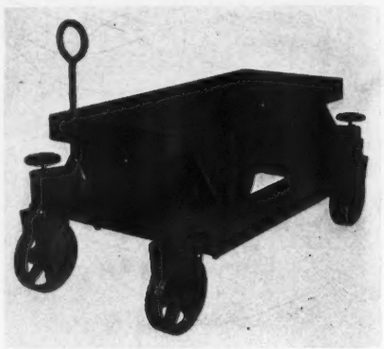
WORLD'S LARGEST MANUFACTURER OF DUST COLLECTING AND BLAST CLEANING EQUIPMENT

PANGBORN CORPORATION · HAGERSTOWN, MD.


tripping mechanism, completely enclosed case, neoprene gasket making switch waterproof for outdoor installations (not true in one quadrant), limit stop mountable in any of 4 quadrants, ball or needle bearing throughout with provision for greasing, flexible leads brought out through bushings in the case with lugs for external connecting. Rating: 100 hp. at 230 volts d.c. Cutler-Hammer, Inc., 315 North 12th St., Milwaukee.

### Die-Handling Truck

Designed for taking out or putting in heavy dies in presses where space for maneuvering is limited. Furnished with auto-type steer at both ends. Turning of wheels is controlled by a turning bar to which a removable handle is attached. It is arranged for hand drawing or towing



back of a power truck and may be drawn from either end. Wheels at either end may be locked in position for drawing at opposite end. Braking arrangement on one wheel on each end holds truck in position when loading or unloading dies. Capacity—8,000 lb., platform—24 in. wide by 60 in. long by 30 in. high, wheelbase—60 in., over-all length—72 in., wheel tread—31 in., over-all width—34 inches. Trucks of other specifications or similar design can be furnished with either a stationary table or with hydraulic elevating table. Lyon Iron Works. 563 Madison St.. Greene. N. Y.

### Sanitary Motor

Sanitary motor available in sizes up to 3 hp. features a totally enclosed nonventilated construction. A drain hole in the bottom (for condensation) is fitted with fine-mesh, stainless-steel screen. It is assembled with chrome-plated "acorn" nuts sealed to motor endplates. Moisture-proof windings are varnish baked on for resistance to water and heat. Ball-bearing cartridge units are prelubricated and sealed. Howell Electric Motors Co., Howell, Mich.

### Fluorescent Units

One-piece Sealed-Flo units feature a sealed-cover construction that protects the lamps and reflecting surfaces from dust and dirt and makes possible use of fluorescent lighting in locations requiring vaporproof and dust-proof fixtures, opal-glass diffusing fixtures, or "unbreakable" glass

# PUT A TOUGH SKIN ON YOUR CONCRETE

## NEW INGREDIENT—PARLON—MAKES PAINT STAND UP ON ALKALINE SURFACES AND DRY RAPIDLY EVEN ON GREEN CONCRETE

PAINT *will* give long-lived protection and decoration to concrete surfaces, if it's made with a Parlon base. This new ingredient makes paint withstand the chemical action of moisture and alkalies that causes early failure of other paints on concrete, plaster, stucco, asbestos-cement board, and similar materials.

Moreover, Parlon paint dries with lacquer-like speed. You can apply it before concrete is thoroughly dry. Thus you save valuable working time when painting old construction, and you save even more time in moving men and equipment into new construction.

If you are allowing alkaline surfaces to go unprotected and undecorated because of unsatisfactory experience with concrete paint in the past, find out about this new paint today.

Progressive paint manufacturers throughout the country are rapidly adding Parlon paint to their lines. You can probably buy it from your regular supplier. If he is not yet ready to give this service, send us his name and we'll be glad to help you. Mail the coupon for complete information about the new paint that really protects and decorates alkaline surfaces.

Cellulose Products Department

HERCULES POWDER COMPANY

*Incorporated*

WILMINGTON, DELAWARE

**GET YOUR COPY OF THIS BOOK**
**MAIL THE COUPON NOW**

Cellulose Products Department
Hercules Powder Company
905 Market St., Wilmington, Del.

Please send more information about PARLON-base paints.

Attention of.....

Company.....

Address.....

Present Supplier.....

GGG-12

At least $156.80 was saved on the cost of these fittings by using ARMCO's "custom-built" method of fabrication.
"Tailor-Made" fittings
SAVE MILL 48%

• This is the story of how a large mill cut costs 48% by using fittings tailor-made for them by the manufacturers of ARMCO Spiral Welded Pipe.

From previous experience they knew that by designing the ARMCO way a great reduction could be made in the number of necessary flanges. As a result, the three fittings cost only $169.58. Had conventional methods been used the cost would have been at least $326.38, including $156.80 for extra flanges alone.

That's not the whole story. Because there were fewer joints, the job went in faster and cost less money. And savings will continue through years of trouble-free service. The fewer joints mean less chance of costly leaks.

See how much you can save on your next piping job. ARMCO Spiral Welded Pipe is available in diameters from 6 to 36 inches —wall thicknesses from 7/64 to ½-inch—with optional coatings. Just mail your plans to The American Rolling Mill Co., Pipe Sales Div., 1031 Curtis St., Middletown, Ohio.

ARMCO

ARMCO
SPIRAL WELDED PIPE

protection. Also facilitates use in such adverse atmospheric conditions as steam, dampness, non-combustible dusts and vapors, it is said. The cover is hinged to the lamp housing and locked in place by hand-operated cover clamps. The assembly can be installed on any of the company's Stream-Liters in service, and with it it is possible to adapt Sealed-Flo units for locations where use of heat and impact-resisting, tempered, plate-glass covers are desirable or in drafting rooms where diffusing glass is indicated. Available in arrangements for two or three 48-in. fluorescent lamps. Benjamin Electric Mfg. Co., Des Plaines, Ill.

### Belt-Driven Exhaust Fan

Two models—with and without penthouse. Features: Protruding orifice for greater air delivery, ball-bearing motors, all-steel construction, heavy-duty die-stamped blade, belt drive. Capacities range from 7,000-30,000 cu.ft. per min. free air. Motors in 7 sizes from ¾ to 1½ horsepower. The Penthouse unit is complete with fan and automatic shutters. Useful in ventilating central areas where duct work to wall would be expensive. Chelsea Fan & Blower Co., Inc., 370 West 15th St., New York.

### Diesel-Powered Locomotives

Line of 4, 5, and 6-ton locomotives features a 4-cylinder, 4-stroke-cycle UD-6 International diesel engine developing 39 hp. at 1,500 r.p.m. Four-wheel drive, 4 speeds forward and 4 reverse, the latter made possible through the reverse gear operating in conjunction with a heavy-duty 4-speed transmission. Other features: Steel tires for traction, dual-spring journal suspension, steel frame, Timken bearings, Standard International Harvester Company parts in engine clutch and transmission. Available in any gage with or without cab, standard or mine types. Brookville Locomotive Co., Brookville, Pa.

### Toolroom Lathe

Series S 16-inch-swing, belt-driven, underneath-motor precision lathe is made in 6, 7, and 8-ft. bed lengths having distance between centers of 34, 46, and 58 inches. Headstock has 1⅜ in. capacity through the

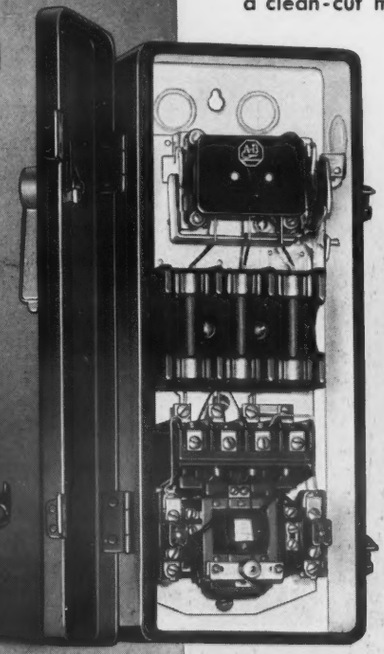
# COMBINATION STARTERS

## Designed for TROUBLE-FREE Service

**BULLETIN 712** Combination Starters—comprising a disconnect switch and automatic starter in one cabinet—have been redesigned for even greater sales appeal. The disconnect switch lever on the front of the cabinet presents a clean-cut modern appearance, and the more compact disconnect switch provides additional wiring room. Nothing has been taken from the reliability of the former construction.

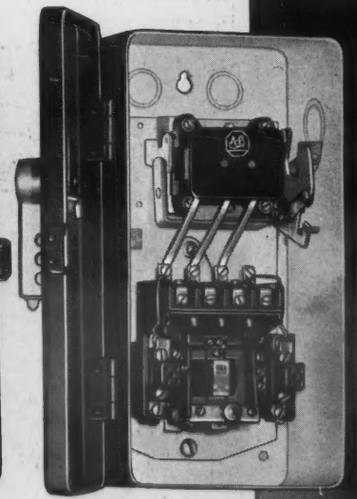
Size 3—Maximum polyphase rating: 30 hp, 220 v; 50 hp, 440-550 v.

Size 2—Maximum polyphase rating: 15 hp, 220 v; 25 hp, 440-550 v.



Size 1—Equipped with fuse clips. The felt gasket seal used with Type 1A enclosure effectively keeps out dust.

Size 1—Maximum polyphase rating: 5 hp, 220 v; 7½ hp, 440-550 v.



Size 0—Maximum polyphase rating: 1½ hp, 110 v; 2 hp, 220-440-550 v.

**ALLEN-BRADLEY** QUALITY

**SOLENOID MOTOR CONTROL**

# For those TOUGH Jobs

## use Motor Control that's TROUBLE-FREE!



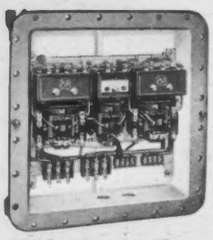
**Hand-Operated Starters**
Bulletin 609—A quick-action manual switch for across-the-line motors. Push-button control and overload protection.



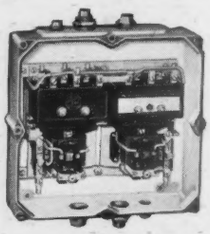
**Across-the-Line Starters**
Bulletin 709—For starting squirrel cage motors. Simple, reliable solenoid construction.



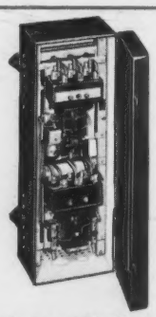
**Combination Starters**
Bulletin 712—A solenoid starter with a manual disconnect switch in one enclosure.



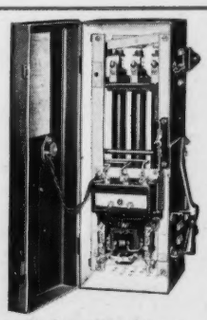
**Multi-Speed Starters**
Bulletin 715—For two, three, and four-speed across-the-line motors. Solenoid construction.



**Reversing Switches**
Bulletin 705—For reversing squirrel cage motors. Provides rugged solenoid reliability.



**Reduced-Voltage Automatic Starter**
Bulletin 740—Provides smooth motor acceleration without violent inrushes of line current.



**Reduced-Voltage Manual Starter**
Bulletin 640—For velvet-smooth acceleration of squirrel cage induction type motors.

Allen-Bradley Company
1321 S. First St., Milwaukee, Wis.
Please send me your bulletin on the following switches.

_____
_____
_____
_____

Name_____
Company_____
Street_____
City_____ State_____

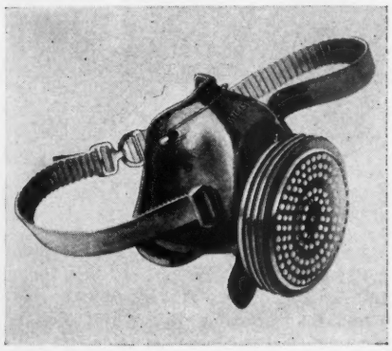
**Send for Bulletin on these Switches**

# ALLEN-BRADLEY

SOLENOID MOTOR CONTROL

QUALITY

spindle and takes collets up to 1 in. capacity. A quick-change gear mechanism provides a series of 48 power longitudinal carriage feeds 0.0015-0.0841 in., 48 power cross feeds 0.0006-0.0312 in., 48 right and left-hand screw threads 4 to 224 per inch. Large-diameter handwheels facilitate adjustments on close tolerance work, adjustable micrometer collars on the cross-feed screw and the compound rest screw are large in diameter. Attachments supplied with the lathe include handwheel-type draw-in collet chuck, telescopic taper attachment, micrometer carriage stop, thread dial indicator, chip pan. Enclosed motor drive provides 8 spindle speeds ranging from 21-725 r.p.m. Lathe bed is a heavy semi-steel casting with 3 large V-ways and one flat way. South Bend Lathe Works, 425 East Madison St., South Bend, Ind.



### Light-Weight Respirator

The Bantam, No. 2140, provides protection against pneumoconiosis-producing dusts and mists, nuisance dusts and mists, chronic acid mist. It is a throw-away filter-type respirator and is said to be so light and easy to breathe through that it can be worn for long periods without discomfort. Has an all-rubber facepiece. Willson Products, Inc., Reading, Pa.

### Time Recorder

Electro-Touch time recorder for use in recording employees payrolls in compliance with the Wage and Hour Act works automatically. A card-locking device is designed to make it tamper-proof and to prevent misplaced registrations. The card must be inserted correctly or the registration cannot be made, it is said. Simplex Time Recorder Co. (Manufacturer); Widmer Time Recorder Co., 42 Broadway, New York (Distributor).

### Live Hose Reel

For use on the company's portable and stationary air compressors. Advantages claimed: Easy mounting—fits any 1½-in. female pipe thread, built-in valve construction—inside reel, extra-strength side members spun and welded to hub, heavy bronze bushings to support reel, free turning. Designed so that 3 ft. of the entire 50 ft. of hose can be pulled from reel and the valve opened to allow air or water to enter. Valve is said to be self-sealing with no adjustments, packings, stuffing boxes. Two


# KIRK & BLUM
## DUST CONTROL SYSTEM
## at Monarch Machine Tool Co.

THE unique System recently installed in the new addition to the Monarch Machine Tool Company plant at Sidney, Ohio, is another outstanding example of how Kirk & Blum Engineers design, engineer and install Dust Control and Fume Removal Systems to meet individual plant requirements. The top of each working station is a large grating through which air is exhausted to pull away all dust, rust, sand, paint spray, etc. These gratings are so located that the workmen never inhale dust or fumes, nor do they have to work in a bent-over position. All piping is entirely under the floor. Total amount of air removed is 50,000 cu. ft. per min. at an average surface velocity of 200 ft. per min.

Regardless of what your dust or fume removal problems may be, Kirk & Blum Engineers, backed by a third century of specialized experience, can solve them to your complete satisfaction. Every Kirk & Blum Installation is covered by a written performance guarantee.

Sanding department at Monarch Machine Tool Company. The down draft ventilation through grille-topped tables makes the sanding operation on painted castings clean, safe and eliminates the need for masks.

New Castings Cleaning Department, Monarch Machine Tool Company. Fine particles which ordinarily would fill the air are now exhausted through the top grilles of the grinding bucks on which the work is placed.

**SEND FOR THIS BOOK**—"Dust Collecting Systems in Metal Industries". Illustrates and describes interesting Kirk & Blum installations throughout the country.

**OTHER KIRK & BLUM BOOKS**

- "Blower Systems for Woodworking Plants"
- "Fan Systems for Various Industries"
- "Industrial Ovens".

Mailed on request to interested executives.

**THE KIRK & BLUM MFG. CO.**
2853 Spring Grove Ave. Cincinnati, Ohio

# IT FINISHES PARTS FASTER AND BETTER —WITH LUBRI-ZOL

● This precision, production honing machine finishes metal parts to any desired degree of smoothness. Its greatest success depends on perfect coordination of three vital factors:—a sturdy construction, an ingenious multi-directional abrading action accomplished in part by an hydraulically actuated work table movement, using Lubri-Zol Hydraulic Oil.

The manufacturers, Micromatic Hone Corporation, of Detroit, find that the uniform precision accomplishment of this machine depends to a substantial degree on the *uniform rate of travel* of the reciprocating work table, which determines that the surface being honed will receive uniform abrasion throughout its length. Uniform travel is most easily obtained with an hydraulic drive, and Lubri-Zol Hydraulic Oil gives optimum performance in meeting this requirement.

Its high viscosity index assures a steadily maintained viscosity within wide temperature ranges. The job runs cooler, and production can be accelerated without losing pressure, because Lubri-Zol does not thin out.

While the high viscosity index of Lubri-Zol Hydraulic Oil is its major advantage in this type of use, its higher film strength serves to prevent wear, and the elimination of sludging assures a cleaner, trouble-free unit for longer operating periods.

Lubri-Zol makes a specialty of difficult industrial lubricating jobs. Whether you are concerned with hydraulic oils or any other industrial lubrication problem, our engineers will be glad to work with you for lower costs and a better output. We work on a "No cure—No pay" basis. Write today to—

THE
LUBRI-ZOL CORPORATION
CLEVELAND, OHIO

LUBRI
REG. U.S. PAT. OFF.
ZOL


styles: With flat sides for wall mounting or for concave air tanks; with one flat side and a concave side to fit over convex-end air tanks. Several capacities for air, water, or gases. Schramm, Inc., West Chester, Pa.

### Infra-Red Lamp

Thermalamp, a sealed-beam infra-red lamp for drying and baking, features even heat distribution and low maintenance. Its lens, of a special green glass which is said to have high heat transmission qualities while retarding passage of visible

light, serves dual purpose of providing hexagonal pattern of even heat distribution and sealing 1,000-watt lamp and gold-plated reflector from fumes and dirt. In cleaning, maintenance man has only to clean outside of lens. Specially designed socket locks into pre-wired channel which mounts an ordinary pipe framework to form oven of any dimension. Ovens are custom-designed for each installation. Applications include rubber curing and baking and drying of paints, textiles, foods, and printing inks. C. M. Hall Lamp Co., 1035, East Hancock, Detroit.

### Multi-Point Indicator

Supplied with from 2-16 interchangeable gage units the indicator indicates drafts, pressures, differentials, and other factors in boiler and industrial furnace operation. Zero adjustments and piping connections for each gage unit are accessible from front of panel and each unit is designed to be withdrawn like a book from a shelf without disturbing other units. Each gage is actuated by sensitive dry-bellows type of diaphragm for ranges from 0-50 in. of water or by a helical element for pressures above 50 in. of water. The gages have 12-in. vertical translucent rear-illuminated scales. Built for flush or projected mounting. Republic Flow Meters Co., 2240 Diversey Parkway, Chicago.

### Unit Heater

Propeller-fan-type heater designed to provide a vertically downward discharge of heated air with sufficient velocity to pervade the working level is available in 2 types. Model BMH for high-ceiling location provides high-outlet velocities, is available in 3 outlet arrangements—No. 1 projects a single column of air straight down, No. 2 projects 2 columns of air

# YES! SAVES TIME, POWER, SPACE, MONEY

**Read Why It Pays To Use The Sensational New Allis-Chalmers Vari-Pitch Speed Changer . . . the Unit That Gives You Smooth UP or DOWN Speed Changing . . . Provides Increased Producing Capacity For Your Machines . . . Gives You Greater Manufacturing Profits!**

Here is one of the eight 22 hp Vari-Pitch Speed Changers on the job at Grand Coulee Dam. Working with Allis-Chalmers motors and starters, these Speed Changers operate rake-type sand classifiers, providing low-cost speed variations to suit changing needs.

**YES! Saves Time!** You can save valuable production time by using the new Vari-Pitch Speed Changer . . . no stopping production while making necessary speed changes . . . no time-wasting change-overs! Get the speed you want . . . instantaneously . . . by turning the hand wheel. Or if you desire, electrical fingertip control is provided . . . a flick of the switch gives you extra-fast speed changes!

**YES! Saves Power!** The Allis-Chalmers Vari-Pitch Speed Changer is a power-saver! Tests under load show amazingly high efficiency ratings. Dynamically balanced sheaves . . . anti-friction bearings . . . long-life Texropes—all help plug power leaks and assure low maintenance.

**YES! Saves Space!** Space is worth money . . . now you can save from 2/3 to 3/4 of the valuable space ordinarily used by bulkier transmissions. Double-shaft extensions let you place this compact, highly flexible unit in the most space-saving spot to do the most efficient work . . . at a cut in overhead costs!

**YES! Saves Money!** Be sure you understand the full money-saving importance of the Allis-Chalmers Vari-Pitch Speed Changer! It eliminates the need for costly multi-speed motors or separate change-overs for each new speed. Be sure you know what it means to have a variable speed transmission that operates easily . . . instantaneously . . . economically! Be sure you have the facts on this money-saving, profit-making performance!

Send today for Bulletin 1266 or call the district office near you. Find out how much you can save in Time . . . Power . . . Space . . . Money . . . by using the Allis-Chalmers Vari-Pitch Speed Changer!

1008

Texrope V-Belts • Duro-Brace Texsteel Sheaves • Texdrive Sheaves • Stock and Standard Cast Iron Sheaves • Vari-Pitch Speed Changers • Vari-Pitch Sheaves • Adjustable Pitch Diameter Cast Iron Sheaves • 2-3-4 Cast Iron Combination Sheaves • Paraline Automatic Motor Bases • Oil Field Drive Equipment and Drilling Rigs.

Belts by Goodrich

**ALLIS-CHALMERS**

MILWAUKEE · WISCONSIN

*Here's the Fixture*

*for the new 100-watt*

# FLUORESCENT LAMP

**This month, the new 100-watt fluorescent lamp is ready! And so is Goodrich—with the new fixture designed for its use! With higher output of light, general fluorescent illumination is now possible for industrial locations where higher mounting and wider spacing of fixtures is desirable. Important features are:**

**1. Proper light control with 14° angle of shielding.**

**2. Highest reflecting efficiency with porcelain enamel finish.**

R L M ELECTRICAL TESTING LABORATORIES

**APPROVED**

***THE KNOLLWOOD, illustrated above, is a new Goodrich fixture bearing the R. L. M. label; properly designed for the new 100-watt fluorescent lamp.***

**Goodrich Fluorescent Fixtures have detachable hood and are equipped with adjustable brackets for chain or conduit mounting. They are also corrected for power factor and flicker with approved ballast equipment. Write for catalog sheets.**

**SOLD ONLY THROUGH ELECTRICAL WHOLESALERS**

**GOODRICH**
**ELECTRIC COMPANY**
OFFICES IN ALL PRINCIPAL CITIES

**GENERAL OFFICES AND FACTORY: 4604 BELLE PLAINE AVENUE, CHICAGO, ILL.**

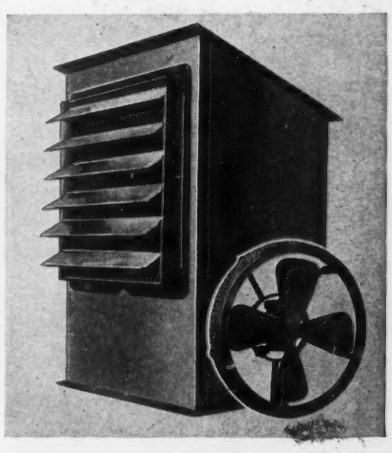
at angles of 30 deg. to vertical, No. 3 projects air at 30 deg. to vertical in all directions. The second type, Model AMH, designed with low outlet velocities for use where suspension may be nearer floor features 2 discharge arrangements—No. 1 provides a louver which directs ½ the heated air in one direction and ½ in the opposite direction, No. 2 has a specially designed outlet for diffusion of heated air. Model AMH for heights 12-18 ft. is available in 6 sizes providing 43,000-193,000 B.t.u. with air deliveries 545-2,620 cu.ft. per minute. Model BMH for heights 18-45 ft. is available in capacities 98,000-500,000 B.t.u. with air deliveries from 1,330-7,050 cu.ft. per minute. The Herman Nelson Corp., Moline, Ill.

### Wing-Style Self-Locking Nut

Vibration-resisting nut features a spring member which when applied expands to locking position to provide a constant tension. Of all-metal one-piece construction, the nut is fabricated from steel and is cadmium plated. Sizes run from No. 6 through ¼ inch. Variations can be furnished for special purposes. Scovill Mfg. Co., 80 Federal St., Boston.

### Penthouse Fans

Line of penthouse fans for venting obnoxious gases, fumes, and dusts features steel construction. The penthouses are available in a range of sizes for housing standard fans of the company's make of



12-48 in. diameter. Sheet-steel walls and shutters are mounted on heavy angle-iron frame. The shutters open and close automatically. The penthouse is placed directly over the opening through the roof of the building and the fan exhausts the air up through the opening or from several floors below by using a duct connected to bottom of fan housing. Truflo Fan Co., Harmony, Pa.

### Carbide Tool Material

Straight tungsten-carbide grade of Kennametal, K4, has a hardness of 92 Rockwell A and strength of 223,000 lb. per sq. in. (Transverse rupture test), it is said. Thermal conductivity is 0.19. This material

# PRECISION AND SPEED

## WITH SOUTH BEND LATHES

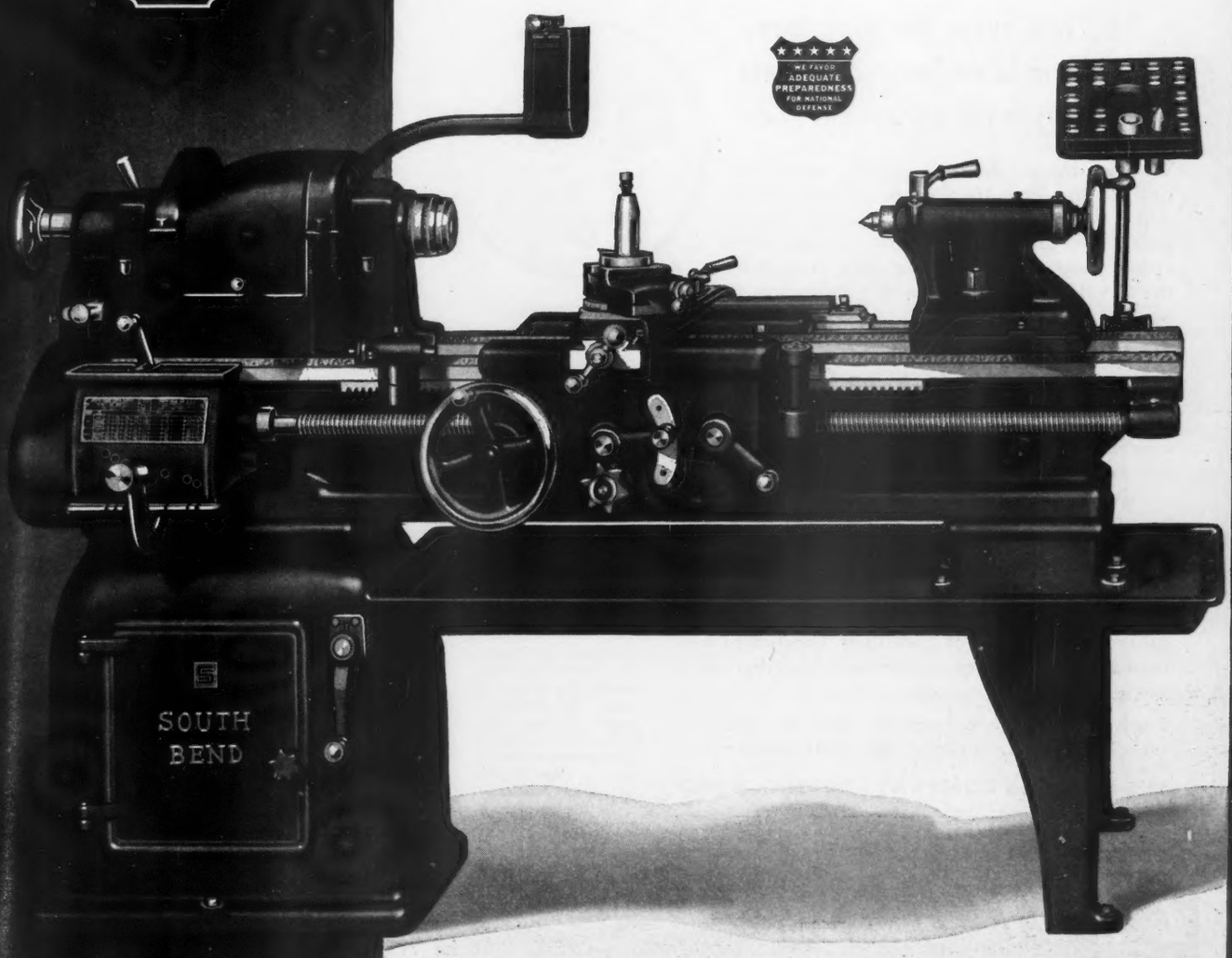
To make a profit, in these highly competitive times, machine operations must be performed quickly and accurately. High spindle speeds and extreme rigidity are essential for efficient machining with sintered carbide or diamond tipped tools, especially when finishing die castings, plastics and other fast cutting materials. Precision and speed are therefore important factors to consider when selecting a lathe.

South Bend Lathes have extreme precision and ample speed for turning out work efficiently and profitably. They are giving satisfactory service in the tool rooms and production shops of America's topmost industries.

Features responsible for the excellent performance of South Bend Lathes include an alloy steel spindle with hardened and superfinished bearing surfaces, a one-piece double wall apron with steel gears running in oil, a powerful worm drive and multiple disc friction clutch for operating the power carriage feeds, and a direct belt drive to the spindle.

South Bend Lathes are manufactured in five sizes, 9" to 16" swing. If you are considering the installation of a lathe, write for our new catalog describing the New Series "S" South Bend Lathe.

TRADE MARK SOUTH BEND TWIN ENGINE LATHES




*Lathe Builders Since 1906*

## SOUTH BEND LATHE WORKS

746 East Madison Street, South Bend, Indiana

Boston Sales Office: 67 Broadway, Kendall Sq., Cambridge, Mass., Tel. Trowbridge 6369

Chicago Sales Office: Room 308, Machinery Sales Building, Telephone State 7283

# RIGHT... 100%
## for this Machine Finishing Job

**...and every DeVilbiss Spray System is engineered for best results in the work it has to do**

Whether you're "dressing-up" big machines or fine chinaware, there's a lot of difference when you use a finishing system that's geared for its particular work. To get top speed, peak efficiency, lower costs, you need the DeVilbiss Spray System that fits its job 100%.

From more than 30 DeVilbiss spray guns and hundreds of nozzle combinations you can pick exactly the right gun for your materials and operations. Among the material containers from 2-ounce cups to 120-gallon tanks is one that fits your needs completely. There are air compressors, purifiers and regulators for intermittent touch-up work or continuous, high-speed production. Whatever your air or fluid hose requirement may be, you'll find a DeVilbiss type that's built to meet it. You can choose the best design of exhaust equipment for your work because DeVilbiss has every size and style, from small bench booths to the largest canopies. And all units of DeVilbiss Equipment are coordinated to function perfectly together as a complete finishing system.

Look at the completeness of the DeVilbiss Line for what it means to you in finishing speed and economy.

**THE DEVILBISS COMPANY • TOLEDO, OHIO**
Canadian Plant: WINDSOR, ONTARIO

**DEVILBISS FINISHING EQUIPMENT**

THE COMPLETE DEVILBISS LINE CONSISTS OF: Spray-finishing equipment ... Automatic coating machines ... Tanks for spray materials ... Spray booths and exhaust fans for vapor and dust elimination ... Air regulators, cleaners and dusters ... Air Compressors ... Respirators ... Specialized hose for paint, air, water, gasoline, welding and pneumatic tools ... Hose connections ... Water and oil guns ... Equipment to prevent offset in printing ... Paint stripers ... Medicinal atomizers ... Perfume atomizers.

**DEVILBISS SPRAY SYSTEMS**


is particularly applicable to the machining of hard, crumbly materials such as cast iron, "transite" pump, Bakelite, porcelain, hard rubber, glass, casein, as well as silicon aluminum, hard bronze, and other non-ferrous materials. It is also useful in taking rough cuts or interrupted cuts on hard metals. McKenna Metals Co., Latrobe, Pa.

### Dump Truck

The 1-yard Handi-Dump Truck collects rubbish in industrial plants and warehouses, removes accumulating light-weight waste materials from manufacturing operations, handles any loads of 500 lb. or less

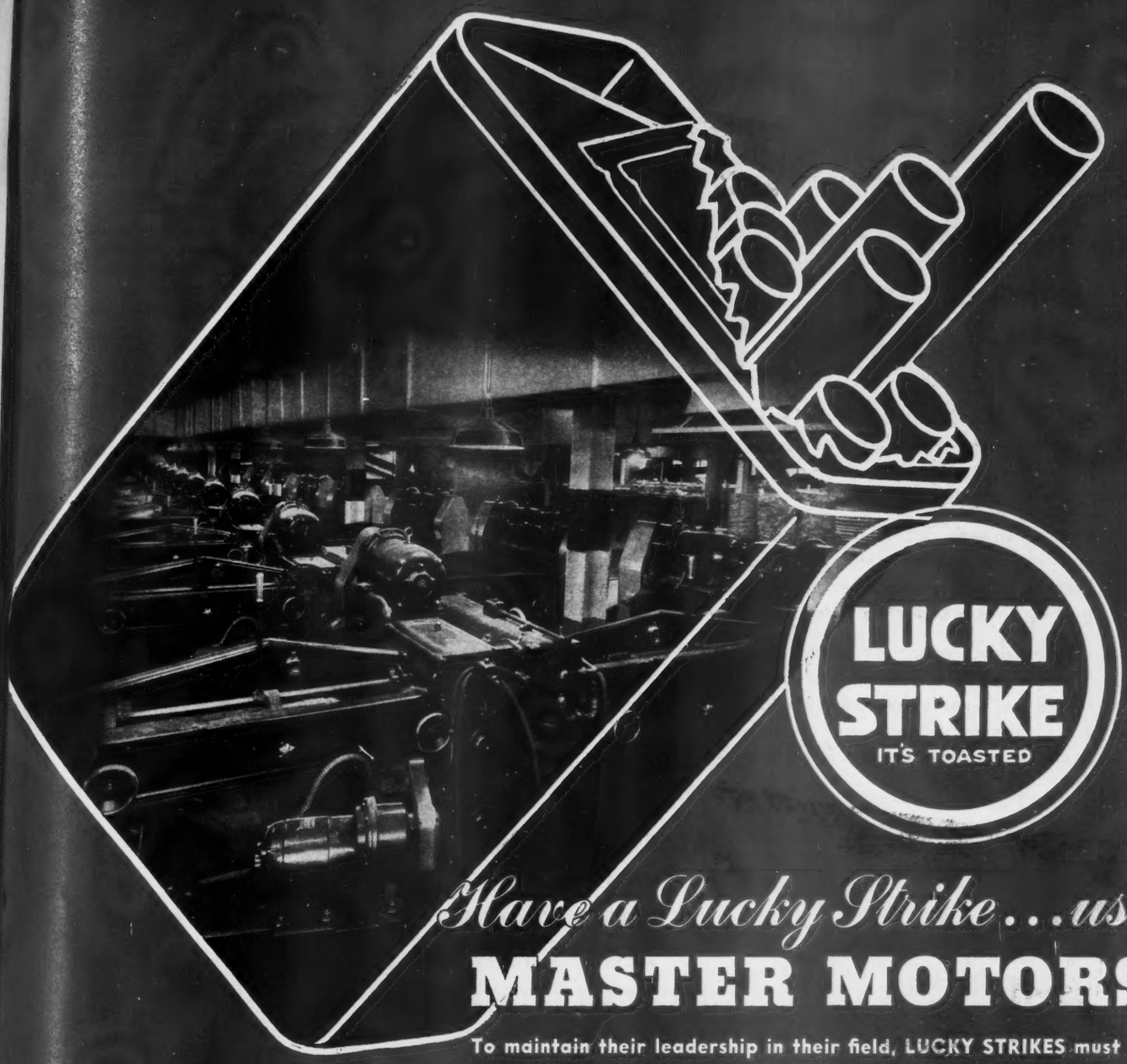
that may be dumped, and is built for easy maneuverability in narrow aisles and runways. It is said that the only manual effort required is in pushing the outfit, it moves on roller-bearing wheels and swivel caster, it dumps clean on release of latch and returns to position when empty. The wheels may be rubber-tired or all metal. Electric Wheel Co., Quincy, Ill.

### Boiler-Water Controls

For use on boiler-feed systems where pumps are employed to return condensate or add make-up water. Two models: Model E is for use with electric pumps and will start single-phase electric motors as large as one h.p. For polyphase or larger single-phase motors it functions as a pilot circuit to operate a starter. Model S is for use with steam pumps and controls an electric steam-supply valve. Utilizing motionless electrode control, the controls operate to maintain the boiler water at the proper level by starting boiler-feed pumps whenever water level falls below a predetermined minimum. Floats and moving parts are eliminated. Johnson Corp., Three Rivers, Mich.

### Fluorescent Lighting

The Masterlite for general and localized industrial illumination and illumination of production areas comes completely wired with a separate wiring channel. When reflector is removed, the wiring is accessible from below. Removable starter switches protruding through the reflector are located in the sockets. Available for 2 and 3-lamp installation, meets RLM Standards specifications for a 48-in. twin 40-watt unit, may




*Have a Lucky Strike . . . use*

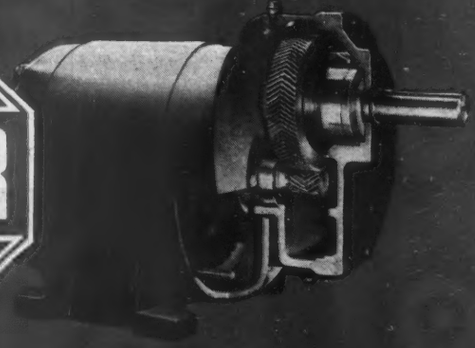
# MASTER MOTORS

To maintain their leadership in their field, LUCKY STRIKES must be made from the best tobacco and with the most up to date equipment and processes. The American Tobacco Company engineers have found that they can save money and still add to the convenience, compactness and safety of their equipment, by using Master Motors built to meet the individual requirements of each particular job.

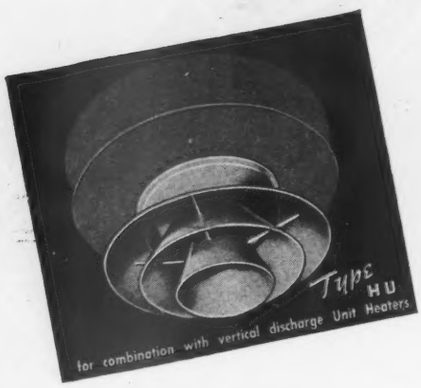
You, too, may have these advantages. Next time you need motors for your plant or your product, make it a job you'll be proud of with Master Motors built to meet YOUR requirements exactly. Investigate MASTER'S unusual ability to serve you promptly and economically.

THE MASTER ELECTRIC COMPANY • DAYTON • OHIO

MASTER



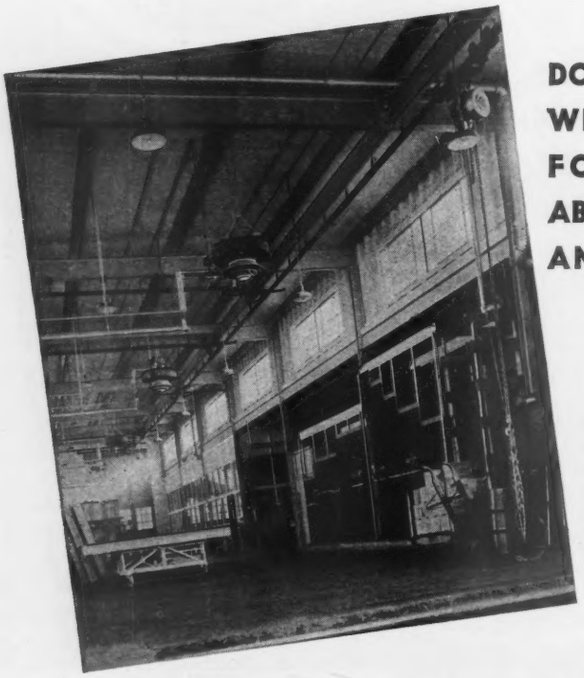
# HERE'S THE ANSWER TO THE PROBLEM OF HEATING LARGE FACTORY AREAS . . .




ANEMOSTAT Draftless Air Diffusers in combination with vertical discharge unit heaters have solved the problem of heating large factory areas.

Users marvel at the way these scientific air diffusers establish and maintain an even, comfortable temperature at the working level throughout the areas they serve with no noticeable movement of air anywhere. Even in shop bays and other points where ceilings are low, operators working directly under the units are entirely comfortable.

By providing conditions conducive to health and comfort, ANEMOSTATS with unit heaters are production boosters. And every factory can secure the benefits they bring, not only in future heating seasons but also for the rest of the present season because ANEMOSTATS with unit heaters can be installed in a few hours.



*Typical of the fast-growing use of* ANEMOSTATS *with vertical discharge unit heaters is this installation in the Washington, D. C. warehouse of the Pittsburgh Plate Glass Co.*

**DON'T DELAY— WRITE TODAY FOR DETAILS ABOUT TYPE HU ANEMOSTATS.**

**ANEMOSTAT**
**DRAFTLESS AIR DIFFUSERS**
*have won acceptance as an essential part of air conditioning, forced air heating and ventilating systems because they assure ideal air distribution. They're made in types and sizes for handling any volume of air at any velocity. Descriptive literature mailed on request.*

**ANEMOSTAT**
**CORPORATION OF AMERICA**
Dept. F, 10 East 39th Street,
New York, N. Y.

*Representatives in Principal Cities*


be mounted flush to ceiling or suspended.

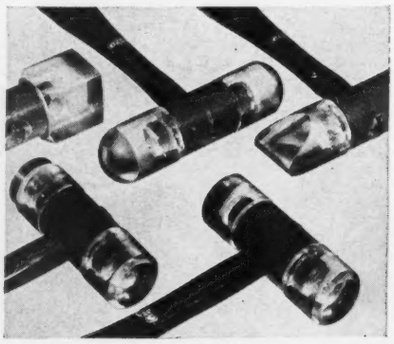
The 50 Foot Candler provides continuous fluorescent lighting for general illumination. Features claimed: All operating equipment is in the wiring channel, the reflector can be removed without disturbing wiring, only one wire entrance is required for an entire row, line wires can be run in from one end or the center. Reflectors attach to wiring channel. For ceiling or suspension mounting, available in single or double-length wiring channels for two or three 40-watt units. The Miller Co., Meriden, Conn.

### Heavy-Duty Scales

Two capacities: Model 1120, 100 lb. capacity; Model 1122, 150 lb. capacity. Features: Weighing platform 6½ in. from floor, open construction to permit cleaning, tower inclined at 30 deg.—revolving to face any direction, dial 16 oz. over and under with ⅛-in. indicator travel for each ounce, short platter fall, carrying handles for portability, aluminum-alloy construction. It is said to weigh accurately in any ordinary out-of-level position. Weighs 130 lb. without weights, stands 46 in. high, is 33¼ in. long and 21 in. wide, has lever fall of ⅞ inch. The Exact Weight Scale Co., 944 West 5th Ave., Columbus, Ohio.

### Soft-Face Hammers

Mechanics, machinists, motor builders, service men will find a line of soft-face hammers useful on assembly jobs requiring a hammer that will not mar finely finished surfaces or delicate machine parts. The



tips are made of Stanloid, a resilient nonmetallic substance. The hickory handles are wedged in a steel center body. Various shaped tips are available: regular face; ball, cross, straight, and offset pein; square tip; regular face with brass insert. Tips are renewable. Stanley Tools, New Britain, Conn.

### Two-Speed Geared Motor

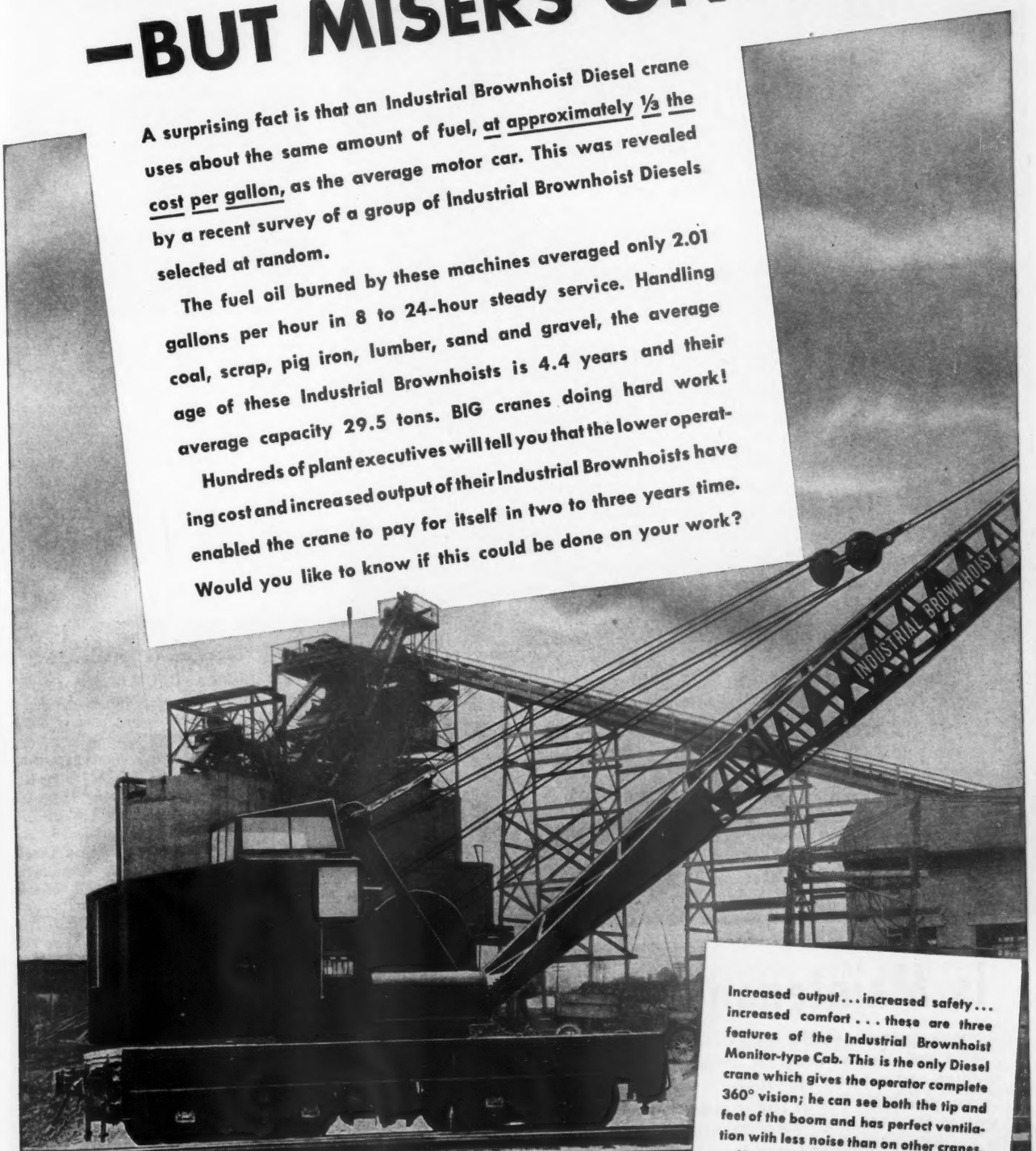
Shockproof geared motors are designed with a double winding which with an interlocking switch provides the operator with a choice of 2 speeds changeable at the pressure of a button. Should be of interest to design engineers and manufacturers of equipment requiring instantaneous speed change—polishing and buffing equipment. Available in various speeds from

# GLUTTONS FOR WORK —BUT MISERS ON FUEL

A surprising fact is that an Industrial Brownhoist Diesel crane uses about the same amount of fuel, at approximately ⅓ the cost per gallon, as the average motor car. This was revealed by a recent survey of a group of Industrial Brownhoist Diesels selected at random.

The fuel oil burned by these machines averaged only 2.01 gallons per hour in 8 to 24-hour steady service. Handling coal, scrap, pig iron, lumber, sand and gravel, the average age of these Industrial Brownhoists is 4.4 years and their average capacity 29.5 tons. BIG cranes doing hard work!

Hundreds of plant executives will tell you that the lower operating cost and increased output of their Industrial Brownhoists have enabled the crane to pay for itself in two to three years time. Would you like to know if this could be done on your work?




Increased output . . . increased safety . . . increased comfort . . . these are three features of the Industrial Brownhoist Monitor-type Cab. This is the only Diesel crane which gives the operator complete 360° vision; he can see both the tip and feet of the boom and has perfect ventilation with less noise than on other cranes.

Monitor-type Cab cranes conform to standard clearances and provide ample head-room in the engine compartment.

INDUSTRIAL BROWNHOIST

BAY CITY, MICHIGAN

DISTRICT OFFICES: NEW YORK, PHILADELPHIA, PITTSBURGH, CLEVELAND, CHICAGO

*Building Better Foundations for Finish*

"Dag" colloidal graphite helps build better surfaces on forgings, stampings, etc., simplifying the finishing operations. It lubricates metal molds, hot press and forging dies, outlasting temperatures that burn petroleum oil.

This material forms a smooth finish on die and mold surfaces, which minimizes sticking, reduces porosity and cracking, building better foundations for polishing, buffing and plating.

The formula used in the preparation of these high temperature-pressure lubricants is dependent upon factors such as the depth of the draw, the intricacies of the part to be formed, but in each case "dag" colloidal graphite is dispersed in the lighter viscosity fluids which quickly evaporate at the high temperatures, leaving only a clean lubricating film of pure graphite.

A note on your letterhead will bring a production sample and Technical Bulletin No. 130 which tells how to use "dag" colloidal graphite for high temperatures and pressures. Your oil supplier can furnish these lubricants containing this material. Call him in for consultation. He will be glad to make a recommendation.

dag COLLOIDAL PRODUCTS

ACHESON COLLOIDS CORPORATION
PORT HURON, MICHIGAN

**Is Maintenance Important?**

**Some companies consider maintenance a necessary evil, others recognize that a well planned program is the best insurance for continuous production and low cost operation.**

**Some of industry's most highly respected maintenance executives have written their views in recent issues of FACTORY.**

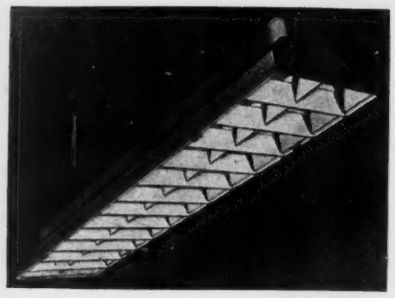
**If you have not already read these articles, we suggest that you review them because they offer many good sound reasons why maintenance is important.**

**Read FACTORY's "Maintenance Services" Section every month for tested methods gathered from plants all over America.**

700-8,000 r.p.m., sizes ¼ to 3 hp. for polyphase circuits only. Walker-Turner Co., Inc., South Ave. at Berchman St., Plainfield, N. J.

### Lamp-Shielding Louver

Steel louver designed in "egg-crate" construction and finished in white enamel is welded into a rigid assembly at each interlocking point. The entire unit is welded to rectangular frame rail which fits into the bead of Stream-Liter reflectors. Two



spring clamps on each side rail snap over the reflector bead to secure louver in position. The louver hides the lamps when viewed from side or end at a normal angle, renders the lamps invisible to the eye except where the lighting units are almost directly overhead, and is said to increase the shielding angle to approximately 23 deg. in all directions. Both the Twin-Lamp and the Triple-Lamp Stream-Liters can be equipped with the louvers. Found particularly useful on long parallel rows of units mounted end to end. Benjamin Electric Mfg. Co., Des Plaines, Ill.

### Machinists' Tools

Line of tools consists of machinists' combination sets with drop-forged hardened square heads, hardened center head, hardened blade and reversible protractor head; machinists' combination set with hardened blade and center head, protractor and square head of cast iron, 4, 6, and 8-in. dividers; 4, 6, and 8-in. inside and outside spring calipers; hardened and tempered center gages; thickness gages; depth gages; surface gages; magnifiers; hook, sliding-caliper, flexible and narrow tempered rules. George Scherr Co., 128 Lafayette St., New York

### Glass-Enclosed Fuses

Underwriters-approved 3-AG fuses, 0-8 amp. for 250-volt a.c. or d.c. service or less, are said to open up new fields of use where cartridge or plug fuses and their mountings had been used before—electric appliances, heavy-duty power supplies, amplifiers, motors. Sleeve-type fuse—4-8 amp.—has a separate glass sleeve over the entire fuse element that takes pressure shocks under short circuits. (8-amp. rating fuse is powder packed.) A space saver, the fuse is small—1¼x¼ in. diameter. Mounting dimensions for two including terminals: 1x2x2¾ inches. Littlefuse, Inc., 4757 Ravenswood Ave., Chicago.

# The PAY-OFF is the PULLING POWER of Dayton V-BELTS with Daytex Cord

Since conversation won't cut production costs, you may be bored stiff when we tell you how Dayton's famed technical laboratories spent seven years of tireless research developing Dayton V-Belts with Daytex Cord in their neutral axis section.

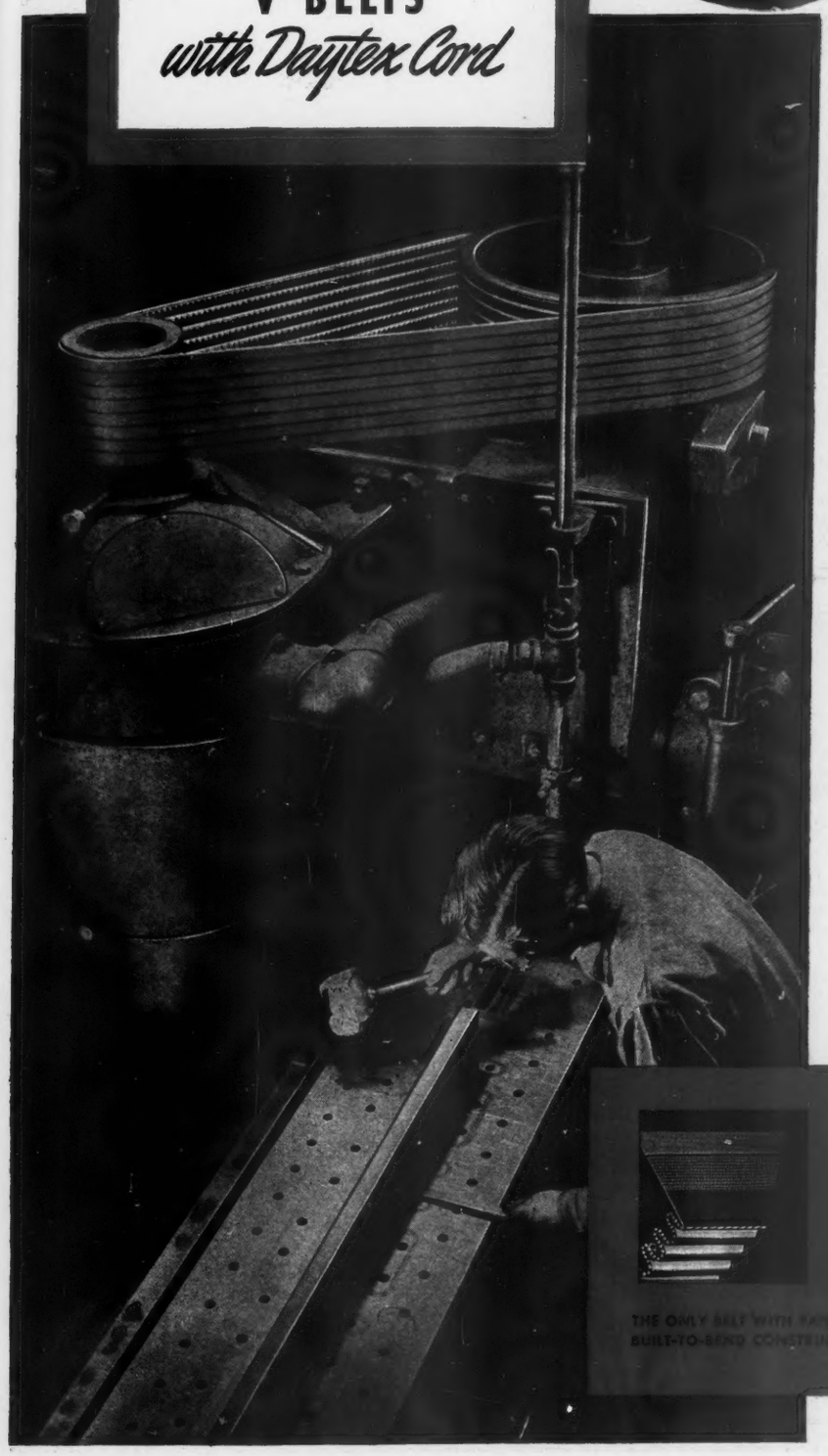
You may even stifle a yawn as you hear about the exhaustive laboratory tests which *prove beyond question* that Daytex Cord has less stretch, longer life and greater strength than the best comparable cord *not* Daytex Processed.

But unless you are allergic to profits you will sit up straight and listen to this brass tack fact—the pay-off is the pulling power of these new Dayton Cog-Belts with Daytex Cord, and *that* means a boost for your bank roll.

So remember this, field applications under all conditions in all types of industries, in all climates and places prove that Dayton V-Belts with Daytex Cord *take and like* constant high speed flexing to give you greater power and lower cost per day, per month or year.

Remember that Dayton V-Belts are outstanding in basic design because they are built to bend with patented cog construction. They reduce adjustments to a negligible minimum. They work on short centers and save space. They save you time, they save your machinery and they save you money. So why not ask your local Dayton distributor for catalogs, data and "The Picture Story of Daytex Cord?"

THE DAYTON RUBBER MFG. CO.
DAYTON, OHIO





Dayton
V-BELT DRIVES
WITH DAYTEX CORD

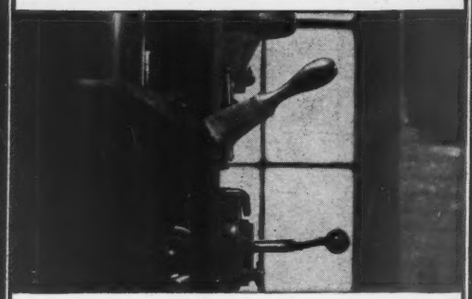
THE ONLY BELT WITH PATENTED BUILT-TO-BEND CONSTRUCTION

MADE BY THE WORLD'S LARGEST MAKERS OF V-BELTS

## *The Cost of an Eye that's Lost... would keep 2,000 eyes*

# AT WORK

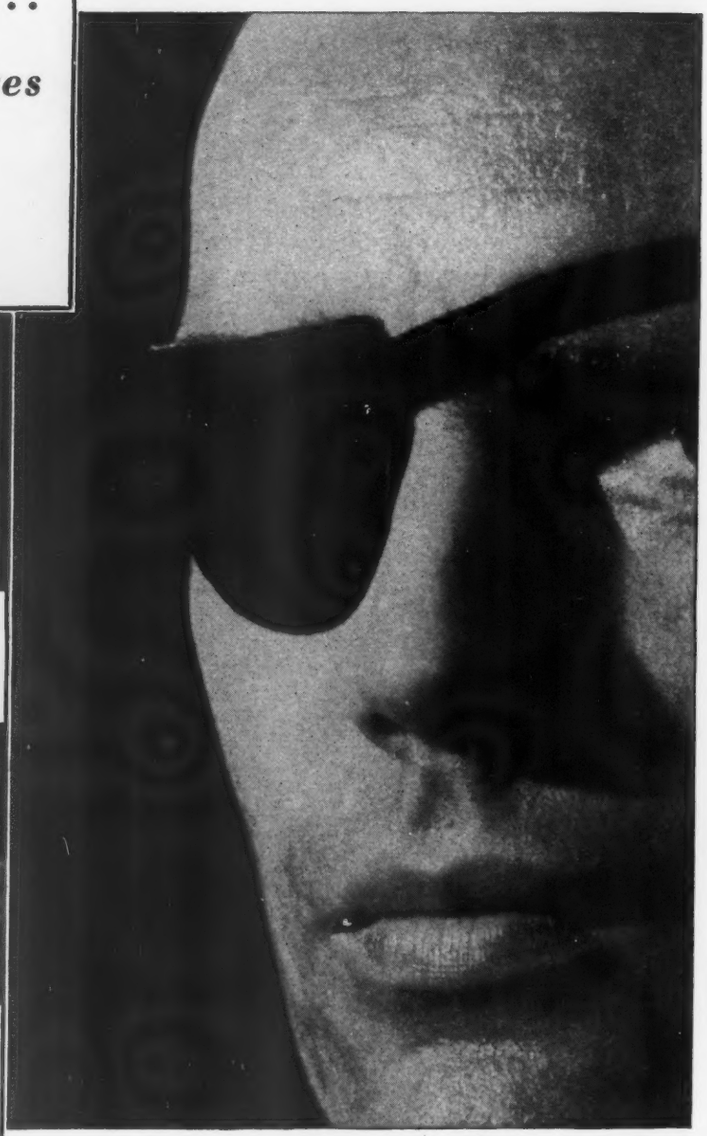
**LOST MAN HOURS.** A chip in the eye can knock a good man out for hours, days, . . . or for all time. Don't lose men, or let them lose their skill, when both are so urgently needed for National Defense.



**LOST MACHINE HOURS.** A chip in the eye can shut down a machine for hours, days . . . *or until you train a new man,* who may not be easy to get. Production is lost. Schedules may be disrupted.

**COMPENSATION AND MEDICAL CARE.** These costs are more or less insured . . . *but an easily-avoidable accident helps no one's risk-rating,* and these costs run on into hidden costs that are *not* insured.

Avoid these Losses . . . AMERICANIZE YOUR WORKERS' EYES.



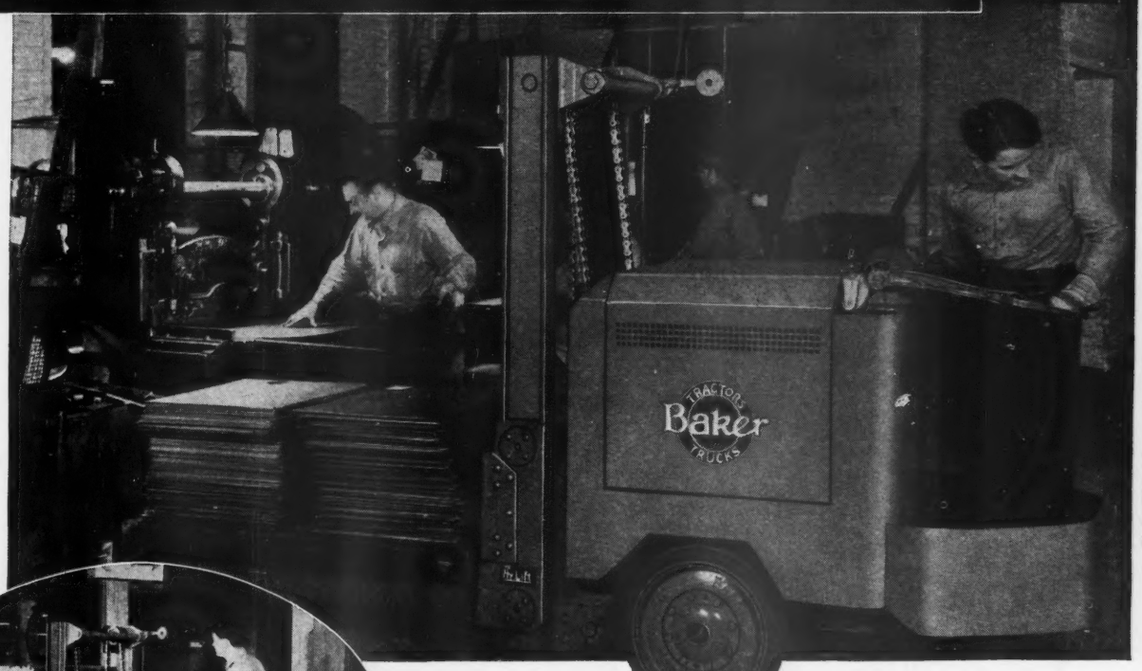
THIS BLACK PATCH would cover the cost of eye-protection for a full-strength regiment of workers . . . good American Goggles that would reduce your eye-liability by thousands of dollars . . . and prevent losses like those at the left.

*The plain fact is this:* A complete program of American Eye-Protection will return more . . . dollar for dollar . . . than any other equipment investment you can make. Your AO Industrial Representative will show you *for how little* you can give *all* your workers comfortable American Goggles, fitted with Super-Armorplate Lenses, deep-curved for *extra* strength. *Write.*

## *American Optical Company*

*Southbridge, Massachusetts, U.S.A.*

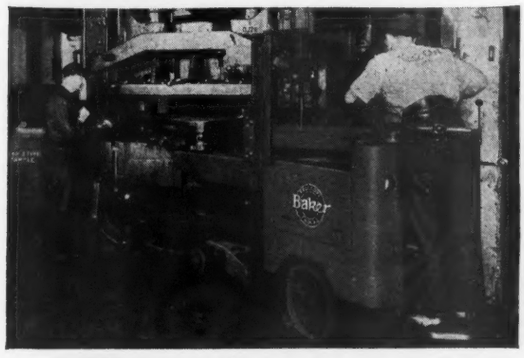
# AMERICAN STOVE COMPANY *cuts handling costs 75% with* BAKER TRUCKS



*(Left)* Baker Truck carrying a bulky load of pressed forms to the spot-welding department—increasing by three times the load formerly handled.

*(Above)* Baker Truck carrying 2½ tons of sheet steel from shearing department to press room—cutting the cost of this operation from 35c to 4c per load.

*(Below)* Baker Truck with die-pulling winch handling a 2-ton die on a large press. Baker Trucks also move machines, heavy machine parts, and are a great help in general millwright work.




The world's largest manufacturer of domestic ranges uses 8 Baker Trucks. The extent to which these trucks contribute to the company's earnings is demonstrated by the record of the Cleveland plant. According to Mr. T. P. Muelhauser, superintendent, three Baker Trucks cut handling costs upwards of 75%, besides speeding up production and increasing plant capacity without adding to overhead.

Let the Baker representative show you how similar savings can be gained in your plant.

**BAKER INDUSTRIAL TRUCK DIVISION**
*of the Baker-Raulang Co.*
2178 WEST 25TH STREET • • CLEVELAND, OHIO
In Canada: Railway & Power Engineering Corporation, Ltd.

Trade mark Registered U. S. Pat. Off.
**Baker INDUSTRIAL TRUCKS**

# Adding Men?

## Enlarge Your Washing Facilities This Quick Easy Way

## Install Group Type Multiple Person BRADLEY Washfountains

● The 54-inch circular Bradleys serve 8 to 10 persons simultaneously, yet insure maximum sanitation because running water is furnished each person from a central sprayhead . . . The deep bowl is self-flushing to prevent collection of water and possible contamination.

### Easy to Install

To install a 10-person Bradley Washfountain requires no more piping connections than a conventional *one-person basin.* For the same number of persons, therefore, there is only one-tenth the amount of piping connections and maintenance.

### Space, Time and Water Saved

About 25 per cent less floor space is required—an important factor today. The time of workmen is saved and records of many plants using Bradley Washfountains show that water consumption is reduced an average of 70 per cent.

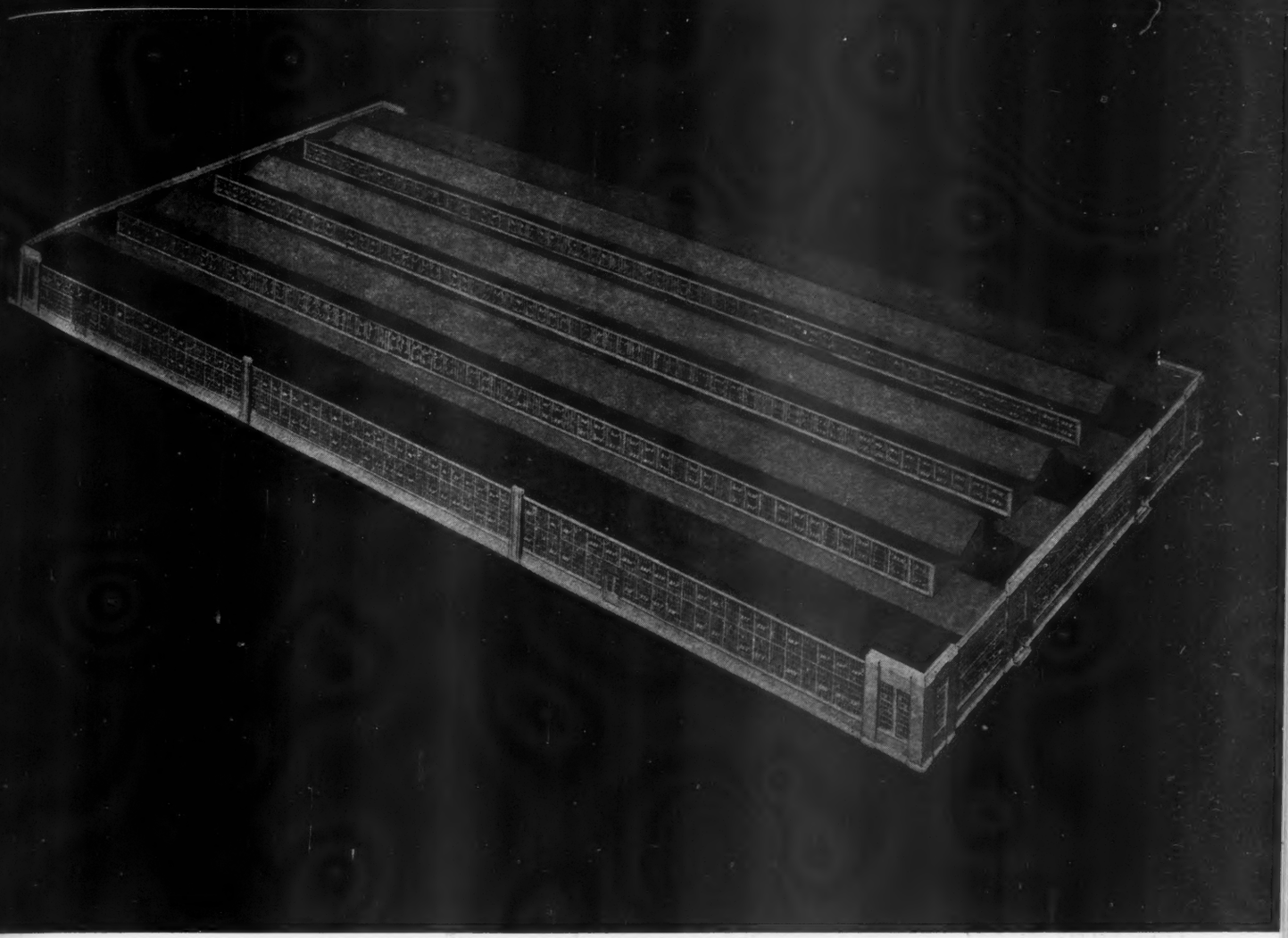
* * *

Our Washroom Consultants are ready to make surveys and suggest economical floor plan layouts. BRADLEY WASHFOUNTAIN CO., 2215 W. Michigan St., Milwaukee, Wis.

### 1941 Catalog Ready Nov. 15

Complete descriptions, illustrations, data, specifications, floor plan suggestions are included to assist you in planning the economical installation of Bradley Washfountains and Multi-Stall Showers. . . . Write at once for a copy.

BRADLEY
WASHFOUNTAINS
*For Greater Sanitation and Economy*

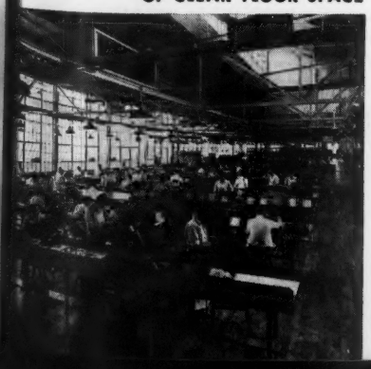


*Factories by Ferguson*

# YOU CAN MOVE IN...IN SIXTY WORKING DAYS

Do you need clear factory floor space quickly, broom clean, with windows washed, ready for your useful occupancy? We can build it for you, guaranteed complete in Sixty Working Days from your approval of our drawings and specifications, which will take us about two weeks to make. These drawings and specifications, when approved by you, become a part of our mutual agreement for your plant. You can actually move into your new buildings and go to work, in Sixty Working Days from date of your contract with us. We will give you further information quickly and cheerfully, without cost or obligation on your part, if you will telephone, wire, or write our Cleveland or New York Office, soon.

INTERIORS PROVIDE LARGE AREAS OF CLEAR FLOOR SPACE



**The H.K. Ferguson Co.**

**ENGINEERS AND BUILDERS**

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INTERIORS PROVIDE LARGE AREAS OF CLEAR FLOOR SPACE

(*Continued from page 49*)

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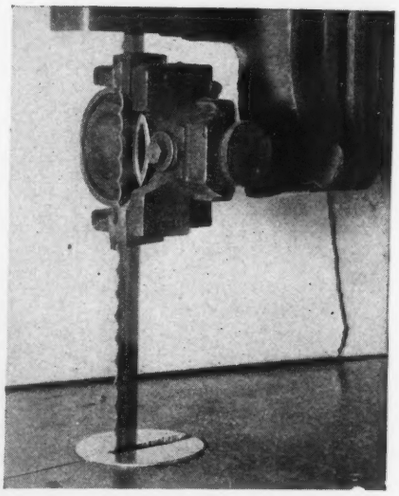

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But when a real lost-time accident occurs out in the plant, the foreman must instantly stop all work at that point and notify the doctor. As soon as the employee is cared for, a committee—the assistant works manager, the personnel man, a representative from the front office, and the doctor—assembles at the point of accident, reconstructs the circumstances, determines the cause, fixes the blame if possible, makes recommendations to prevent a recurrence.

On another day, I observed a further phase of industrial medicine—the periodic physical examination of the employees. At Servel, as in many intelligently operated companies, the

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physical examination begins with the executives, works down through the office force to the factory. Everybody must take the same dose.

The examinations proceeded without incident except when the record sheet of former examinations showed the employee to have some physical condition that should be cared for or watched. Perhaps it was bad teeth, a hernia, weakness of throat or lungs. "You'll have to have that treated," and "Good, that's coming on all right," were remarks I overheard. Sometimes the examination led to a recommendation that the employee be transferred to other work—for instance, that a man with a persistent cough be given outdoor work, a man with a troublesome hernia an easier job.

These physical examinations, bringing the employees into close intimacy with the doctor, reveal still another aspect of industrial medicine. For instance, Dobbins, noting a man's nervous state during his examination, discovered that the man was ridden by the idea that his foreman was down on him. The idea was entirely imaginary. Later Dobbins spoke to the foreman. "Pat Tom on the back now and then." The foreman did. Tom forgot his obsession.

### Helped Jim Pay Doctor

Another foreman reported to Dobbins that Jim, one of his best men, was slipping. Dobbins summoned Jim to his office. He found that a doctor was threatening to garnish Jim's pay for a $350 appendectomy fee. Jim still owed $250. Dobbins called the doctor up, berated him for making such an exorbitant charge, then arranged that Jim get a loan of $75 from the company loan fund. "Give that to your doctor, tell him that's all you're going to pay, take it or leave it." Jim's doctor took it. Jim went back to his job, again an efficient workman.

The old-fashioned plant doctor was looked on askance by both employees and medical profession. Like as not he was a broken-down medico who had failed in private practice. His chief concern was to stand in well with the management by doing employees out of just claims when injured. The modern industrial doctor has the respect of his profession. He is essentially the personal physician to each individual employee. And, by being that, he renders his maximum service to management.

Obviously, not every medical man is qualified for the job I have pictured. To medical competence must be added a thorough knowledge of the manufacturing processes of his plant, executive ability, and imagination. Above all he must be a man who likes mixing with all kinds of people, and whom all kinds of people like. "Hi, doc!" was the universal greeting of man and foreman as Dobbins strode through. The medical director of another company, which has a staff of 80 doctors spread over a large number of plants, told me that when he visits one of his plants with its doctor and hears the workers sing out, "Hi, doc!" he knows his subordinate is doing a good job. Philip Drinker, Professor of Industrial Hygiene at Harvard, says that the medical student who in his college course has worked in a mine, factory, or lumber camp has an invaluable background for an industrial career. He has the worker's point of view.

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Premiums on compensation insurance are rated on the accident record of the plant. The fewer the accidents, the

"WOODPECKER Welding", because the current is applied intermittently . . . applied like the repeated pecks of the woodpecker's bill.

Used for bringing thick pieces up to fusion temperature gradually, this intermittent method reduces electrode-heating and burning, giving the water circulating in the electrodes an opportunity to carry the heat away from the points.

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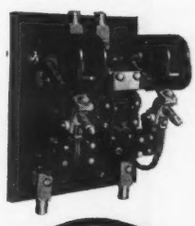

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*(Continued from page 49)*

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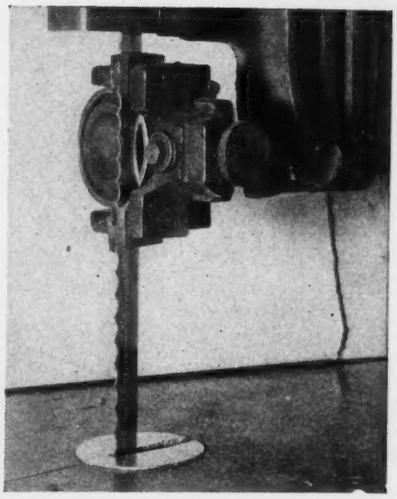

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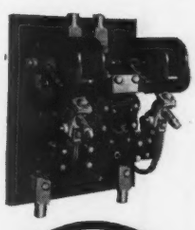

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lower the rates. By cutting down accidents, Servel in the past five years has saved enough in premiums to more than pay for the entire health and safety plan, including hospital, equipment and supplies, salaries of doctors and nurses.

There is still another benefit at Servel which cannot be gaged exactly in dollars and cents—a sharp reduction in labor turn-over. One reason obviously is that minor injuries and illnesses, whether occupational or not, are usually caught at the start. Another, employees talk out their imaginary illnesses and brooding resentments with the doctor, and do not quit the job for no reason. Still another, the news spreads that this is a safe, healthy place to work. People who want permanent jobs gravitate here and stick.

So, here is the achievement of industrial medicine at a modern plant set forth clear to see. To those who claim they can't afford a full-fledged medical plan, the answer from this evidence would seem to be that *they can't afford not to have one.*

Surveys show that as plants go down in size, medical services in general diminish toward the bare legal requirements of first-aid. This is serious. Over 62 percent of workers in the U. S. are in plants of less than 500 workers each; 30 percent are in plants of less than 100 each.

Yet the rewards for even the simplest preventive work are often striking and immediate. An Ohio plant with 115 men put in a dispensary at a cost of $600. Supplies and medical service with a part-time doctor came to $1,660 a year. There was an immediate saving in absenteeism of $3,420, and labor turnover was cut 25 percent. An Eastern plant with 200 men frequently had serious interruptions of production because men were out with common colds. Installation of unit heaters, on the recommendation of a physician, cut absences from colds from 44 a week to 2 a week.

Most small plants use a doctor on call. This isn't real medical care. Such a man knows little or nothing of the manufacturing processes of the plant and their hazards. He is not interested in prevention work. His only contact with the employees is when somebody gets hurt.

The real solution, it seems to me, is for a group of small plants to get together and engage a doctor who knows something of industrial hygiene and will devote all his time to their work. I know of two such arrangements working very successfully.

### Cost Is Kept Low

In Philadelphia, a packing plant, a bakery, a chewing-gum factory, and a lithograph company, with a total of 1,700 employees, employ one doctor who has regular hours at each plant, makes his rounds daily. Costs of medical care at these plants run from $11 per year per employee at the gum plant down to $6 or $7 at the others. Ten dollars a year is considered a very fair figure for a small plant. In Binghamton, N. Y., a film factory, a shoe factory, and a chain of bakeries employ one doctor who has regular hours at each plant. Here, too, I noticed as I made the rounds with these earnest young medical men, the workmen at every plant sang out "Hi, doc!" And the doctor greeted most of them by their first names, showing that a part-time doctor, if he is the right sort, can work into his job and get the confidence of the men just as well as a man who is at the plant all day and every day.

The National Association of Manufacturers has organized a Committee on Healthful Working Conditions, with Dr. Victor G. Heiser as medical consultant, to work especially on this problem of helping the small plant get medical care for its workers. In 34 states the medical societies have established committees on industrial health; many county societies are setting up committees, too. Their purpose—and that of the state

LOOK at these features and you will decide to BUY! Compact, modern die-cast body, helical-cut gears for smooth performance. 2-pole safety switch. Every moving shaft mounted on a friction-free ball or needle-roller bearing. Powerful Universal motor for fast drilling.

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bureaus of industrial hygiene—is to stimulate the medical profession to an interest in industrial work, to help industries get good medical service.

But a program for health and safety cannot be handed to employees with a "There, take it and live up to it." As Servel has done, an enthusiasm for health and safety must be created. An executive from another plant walked into Dobbins's office, exclaiming: "I want to shake hands with the man responsible for this remarkable record!" "Don't shake hands with me," said Dobbins. "Go out and shake hands with the men in the plant. They did it!"

## Controlling Costs on Multiple Machine Operations

(*Continued from page 60*)

attention. This would enable the operator to utilize his idle-man time. The "factor" of a job requiring the constant attention of an operator is always 1.00; however, when running the job to fill in on an automatic job, the factor on that job becomes 1.00 minus the factor on the multiple or the sum of a group of multiple machines. This also enables the cost department to allocate prime labor properly.

For example: Running a hand-feed drillpress with two automatic mills is a job requiring 100 percent attention. The rates on the mills are:

| *Man* | *Cycle* | *Factor* |
|---|---|---|
| 1.00 | 7.00 | .143 |
| 1.50 | 9.00 | .167 |
| | | .310 or 31% of Standard Number of Machines |

This means that 1.00 minus 0.31 equals 0.69, or 69 percent of the operator's time should be spent operating the drillpress. If this combination was run for three hours, the drillpress job would be charged with 69 percent of three hours or 2.07 hours of prime labor.

Prime labor on the automatic machine jobs would be computed in the same manner illustrated in the preceding example.

When this system is properly applied, the clerical help necessary is very little, rate setting simplified considerably, costs are properly allocated, and ultimately production and efficiency are really controlled.

EXPENSIVE floor maintenance is a thing of the past when U·S·S Multigrip is installed. These durable floor plates can take the pounding of heavy traffic year after year with little wear.

They furnish permanent, safe traction in any direction, reducing accidents due to slipping.

Multigrip is easy to clean. Water drains off quickly. It lessens the danger from snow, oil or grease. Multigrip is supplied in wider sections than any other floor plate, making installation faster, more economical. It can be cut to any size required. Write for complete information and prices.

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*Pittsburgh and Chicago*
Tennessee Coal, Iron & Railroad Company, *Southern Representatives*
Columbia Steel Company, San Francisco, *Pacific Coast Representatives*
United States Steel Export Company, New York

UNITED STATES STEEL


## Quick Training Gives Lockheed the Man It Needs

(*Continued from page 57*)

program to be inaugurated in an aircraft factory in the United States. These men will be our skilled workers and production leaders in the next few years. They have been carefully selected from the standpoint of aptitude, temperament, schooling, and experience. The apprentice course ordinarily covers a period of four years, but we have been permitted to evaluate the work-experience of the men selected for training, and in some instances have been able to start them with a maximum of 2 years' credit on a 4-year course. This means that within 2 years from the date of starting their apprentice training they will be qualified journeymen.

### Related Subjects Studied

In addition to on-the-job training, the apprentices are being given instruction in technical related subjects 4 hours per week in the Burbank schools, with Lockheed supplying the instructors. Subjects include metallurgy, aircraft drafting, physics, mathematics, descriptive geometry, stress analysis, operations and planning, advance drafting, safety and first aid. The men are

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Cut-Off Operations

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given full pay while taking instruction. Many of the apprentices supplement their required instruction by taking special trade extension courses.

Although it usually takes 6 to 8 years to develop a real all-round tool-and-die maker, jig-and-fixture builder, or pattern maker, with the cooperation of the nucleus of tool-and-die makers, jig-and-fixture builders, and pattern makers, we are making production jobs out of these crafts, as in Continental die work, form-block making, electric arc welding, and structural steel assembly jig building. In addition to our apprentices, we are taking machine operators and specialists, and training them in separate phases of the crafts.

Under the present emergency our machine operations are rapidly being organized along production lines with our experienced machinists being used as leadmen in directing the work of learners and less experienced men. Through our trade extension courses, these men are given an opportunity to broaden their skill and are advanced as rapidly as possible to new machines.

The top management at Lockheed and Vega, long before the training of men for jobs became an emergency measure, lent its full support to the training program, which, we believe, accounts for the excellent results we are getting under pressure and for the response of the rank and file of our employees. It has been, and still is, Lockheed and Vega policy to advance employees periodically, at the same time increasing their pay. At frequent intervals men are given an opportunity to express their preference for the type of work they would like to do. This accounts for the fact that employees have put forth greater effort to advance themselves and to prepare themselves for advancement.

### Vocational Guidance Offered

Promotions, so far as it is humanly possible, are made on the basis of merit, with the best-qaulified men getting the better jobs. Adherence to this rule, and adherence to a policy of extending vocational guidance from our staff of experts to men throughout the plant, is reaping its own reward in increased productive manpower. The investment in time, money, effort, and supervision in this program is being paid back with increased production at a time when we need it most.

To handle our training program it has been necessary to build up a special staff of men and women experienced in administering this type of work. An additional 135 instructors are working under the direction of the head of the department.

One cannot help reflecting, as the preparations for defense proceed, that in this nation, which has developed mass production to a higher degree of perfection than any other country, most of our people still lack an appreciation of the fundamentals of factory production.

### Change Emphasis in Education

Our educational system is set up primarily to develop our young men as consumers and not as producers. We are living in a machine age, laughing at the horse-and-buggy days, yet we have not trained our people or our leaders to understand the needs of the age in which we live. Our high schools are letting young men who are not preparing for professions go out with inadequate instruction in basic mathematics and sciences. When these youngsters present themselves to a factory for employment, they find to their chagrin that they are not adequately prepared to step into the semi-skilled worker class.

There is a need all along the line to awaken school authorities, parents, and the young people themselves to an appreciation of the fact that there is a career in the field of production, and that those who are to succeed must be properly prepared for it.


Users say—"Colson Drum Trucks Perform a Remarkable Service from Safety and Economy Standpoints"

Chicago, March 29, 1940

Colson Corp.
Elyria, Ohio
Attn: Mr. R.H. Kelly

Gentlemen:

I am very much pleased with the performance of the four drum trucks we recently purchased from you.

We have a considerable volume of freight in heavy barrels to handle at South Water St., and find that one of these trucks in the hands of even a slight man is performing a remarkable service both from a safety and economy standpoint.

Prior to the use of these four trucks on barrels it required considerable effort to get heavy barrels on and off dollies, and there was ever present the possibility of injury.

With your truck we have eliminated the injury feature entirely and are able to handle the barrels as I have said, much more economically.

Yours very truly,

AGENT

RW

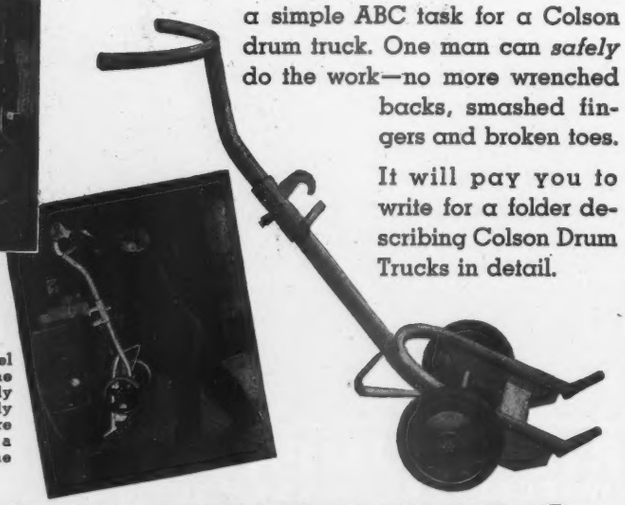
WHETHER you handle one barrel a day or a thousand—a Colson drum truck means more productive handling for you and greater safety for your operators.

A railroad faced a difficult problem in handling barrels and drums because freight was loaded on dollies and distributed by means of a tractor train to various points in the warehouse. Barrels and drums had to be hoisted to the dollies by hand.

The pictures tell the story much more graphically than words. Just a simple ABC task for a Colson drum truck. One man can *safely* do the work—no more wrenched backs, smashed fingers and broken toes.

It will pay you to write for a folder describing Colson Drum Trucks in detail.

**OUT OF THE CAR.** One man can load the truck with the heaviest barrel or drum.

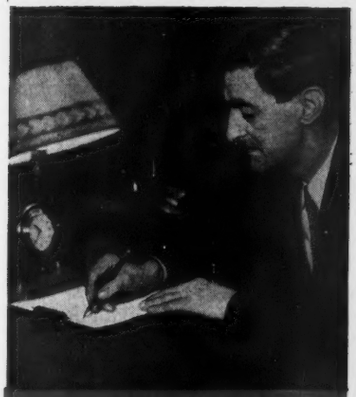


**UP TO THE DOLLY.** The heel of the toe prongs on the truck rests on the dolly and up she goes—ready to be hauled anywhere and unloaded by a drum truck in the same manner as loading.

THE COLSON CORPORATION
ELYRIA, OHIO
Offices and Agencies in Principal Cities
CASTERS • INDUSTRIAL TRUCKS AND PLATFORMS • LIFT JACK SYSTEMS
Colson

# A Tip from TAMPA

## *after 9 Years of "Exceptionally Good Results"*



CHIEF WM. B. STUART of Tampa's Water Department pumping station. His hobbies are clock-making and sweet-running turbines. For the latter he specifies *Texaco Regal Oil C.*

**THREE DE LAVAL** Steam Turbine pumping units in Tampa (Fla.) Water Works. Formerly, the lubricant replaced every 4 years, but now increased to 8 years since changing to *TEXACO REGAL OIL C.*

CITY OF TAMPA
WATER DEPARTMENT

Tampa, Florida, April 3, 1940

The Texas Company,
Atlanta, Georgia.

Gentlemen:

On the ninth anniversary of my change to Texaco Regal Oil "C" in the De Laval Steam Turbine pumping units in the City of Tampa Water Works plant, I felt you would be interested in knowing of the good results I have experienced with your products.

The first supply of Regal Oil "C" was in use continuously for eight years without trouble of any kind. When the time arrived to renew the oil I felt no hesitancy in placing Regal Oil "C" in the system again.

Due to the hard service required of oil in the high speed Turbines and reduction gear sets, I considered it had given exceptionally good results. I would not hesitate to recommend this product to anyone for similar use.

Taking this opportunity of thanking you for the engineering service rendered as well as the cooperation of your laboratory, I am,

Yours very truly,
Wm B. Stuart
Chief Engineer

WBS/s

YOU, TOO, can get similar results in your turbines. Trained lubrication engineers will gladly cooperate in making savings with *Texaco Regal Oils.* Phone the nearest of more than 2300 Texaco warehousing points in the 48 States, or write:

The Texas Company, 135 E. 42nd St., N. Y., N. Y.

**TEXACO Regal Oils**

TEXACO REG. T. M.

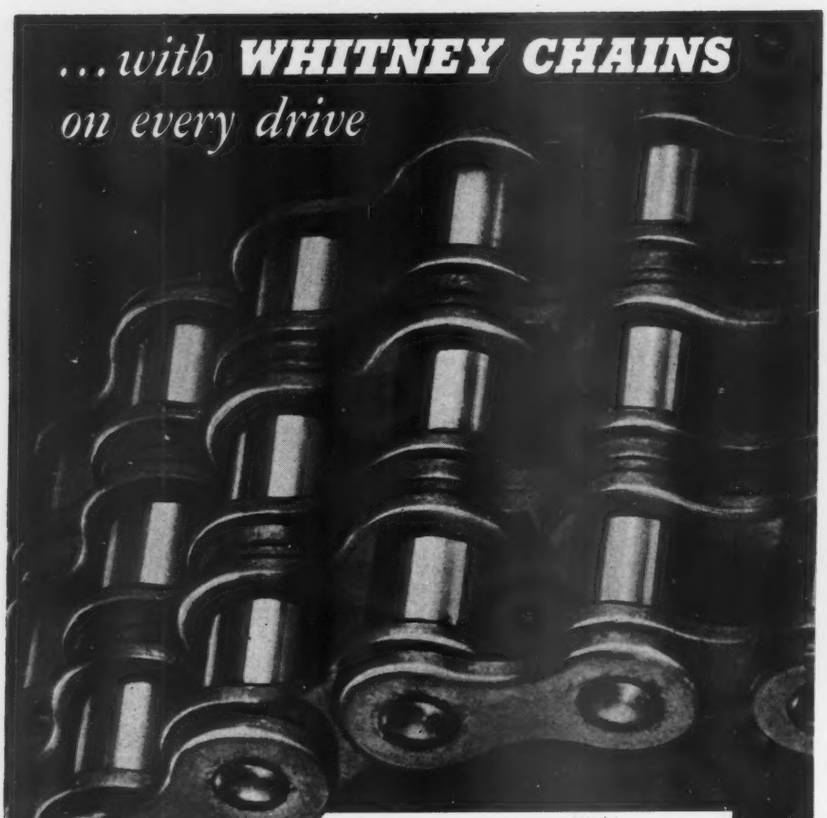
**FOR TURBINE LUBRICATION**

**TEXACO DEALERS INVITE YOU TO ENJOY**

**FRED ALLEN** in a full-hour program every Wednesday night. CBS, 9:00 E.S.T., 8:00 C.S.T., 10:00 M.S.T., 9:00 P.S.T.

**METROPOLITAN OPERA** every Saturday afternoon, NBC. See local newspaper for time and station.

# Full Preparedness
## FOR FULL-POWER DEMANDS



Power is the lifestream of National Defense. And to keep it flowing freely... 24 hours a day if necessary... put Whitney Chains on every drive. For Whitney Chains are designed . . . *and armored with alloy steel* . . . to deliver full power at constant speeds that make for top production. So tell your engineers to call in a Whitney engineer . . . *today.*

**WHITNEY CHAINS**

**The Whitney Chain & Mfg. Co., Hartford, Conn.**

**WHITNEY PRODUCTS** Roller Chain & Sprockets, Silent Chain & Sprockets, Conveyor Chain & Sprockets, Roller Chain Flexible Couplings, Automatic Load Limiting Sprockets, Automatic Drive Tensioners, Woodruff Type Machine Keys and Cutters.


**Management Shorts**

(*Continued from page 72*)

make up one, two, or three hours in overtime. He can then earn the penalty money by working a few extra hours, and that will soften his load.

The executive committee, in all cases, cautions the person (or persons) responsible for the errors so that they will in the future use greater care and diligence toward the elimination of errors—thus better satisfying management and serving the club's own interests. The elimination of errors preserves the funds of the club for its own uses.

The $1,250 is to remain on deposit until all claims against the club have been settled up to December 31. After that time the balance may be used for whatever purpose the club elects.

The basic principle of this plan is an effort on the part of management to curtail errors and, more than this, to instill in the minds of all men that they must show an interest, and exercise due caution in their work, indicating their responsibility for a correct job.

## PRODUCTION METHODS AND MATERIALS

### Instrument Control Adds to Furnace Life

SOURCE
*Leeds & Northrup Company*
*Philadelphia*

Records of a mill producing open hearth steel show that the use of instruments for checking roof temperature and providing automatic reversal based on temperature difference has made notable savings. For example, on the basis of figures taken prior to the installation of these instruments, there was an increase of approximately 50 percent in tonnage, 75 percent in roof life, 50 percent in the life of the front wall, and 22 percent in fuel.

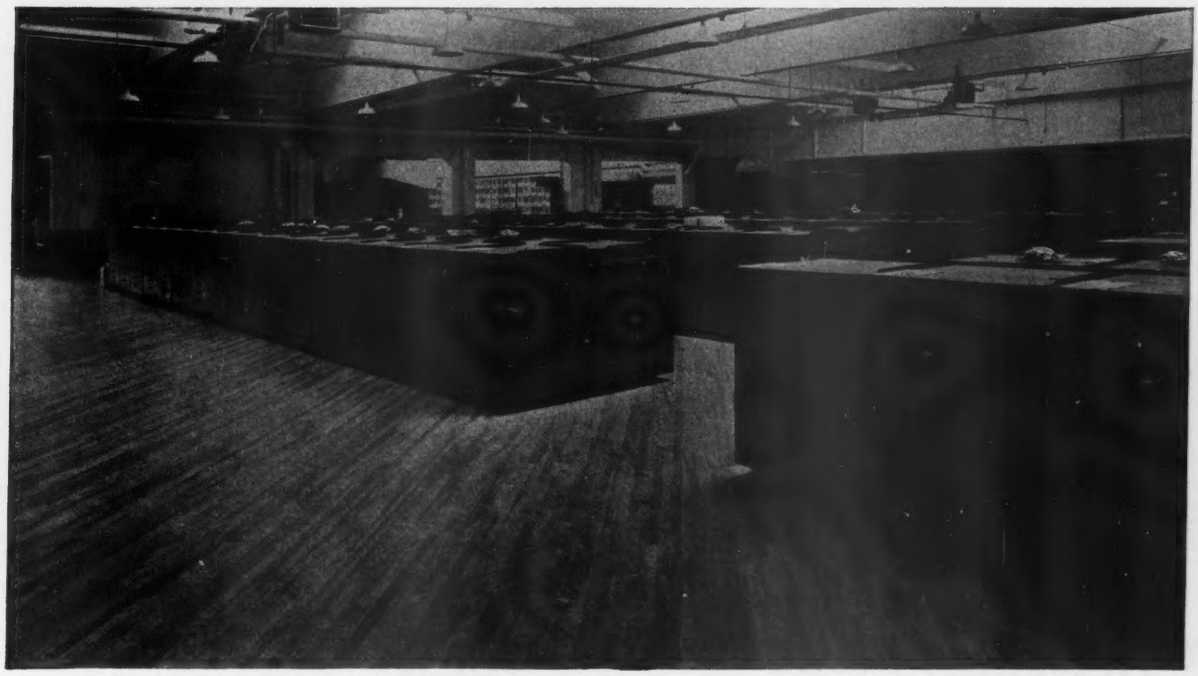
•

### Tray Serves as Degreaser Basket to Save a Handling

J. M. ROBINS
*Yankee Metal Products Corporation*
*Norwalk, Conn.*

Demand for one of our products jumped so spectacularly recently that we found ourselves receiving, daily, orders for more than we could produce during one day. It became essential,

# 3 Acres of Hard Maple ...WHERE THE CASTERS ROLL!



*Shipping room at Helms Bakery, Los Angeles, floored with Northern Hard Maple. . . . Photograph by courtesy of the designers, Grant & Bruner, Architects and Engineers, Los Angeles and G. H. Tennant Company, Minneapolis.*

Small casters on large cabinets require less turning radius. However, small casters also bite more seriously into floors—under heavy loads, are severe on floors. But not on Northern Hard Maple.

The heavy cabinets in the above shipping room at Helms Bakery can roll merrily back and forth for years without noticeable scarring of the floors. It's tough-fibred, tight-grained Hard Maple, with all the remarkable resistance to indentation and abrasion that this harder hardwood offers.

Helms has floored for the years to come and, when final flooring cost is counted, will have saved handsomely by choosing Northern Hard Maple—with savings in maintenance and cleaning costs, as well as in cost per year of flooring service.

Hard Maple will give you this economy—and with it, resilience, warmth, comfort and sanitation, and a cheerfully clean and attractive floor.

**MAPLE FLOORING MANUFACTURERS ASSOCIATION**
**1787 McCormick Building, Chicago, Illinois**

*See our catalog data in Sweet's, Sec. 11/78. Write for photographic folder, and leaflet on heavy-duty finishes for old or new floors.*

*By specifying trademarked* **MFMA** *Maple—in strips or blocks—you insure receiving all Northern-grown Hard Maple, association-supervised and guaranteed.*

# Floor *with* MFMA Maple

REG. U. S. PAT. OFF

(NORTHERN HARD)

• • GAGING PRECISION by TOUCH

is only approximation compared to VISION

The sense of *feeling* or of *touch* as applied to fixed gages when used to determine the accuracy of specified sizes on machine parts, depends upon the sensitivity of the inspector and varies with each individual.

But, a visible indicating hand, moving over widely spaced dial graduations, is something which can be seen with the same degree of accuracy by *anybody*.

This fact is one of the strongest reasons for using Dial Indicators even for comparatively large tolerances. Send for catalog.

FEDERAL PRODUCTS CORP., PROVIDENCE, R. I.

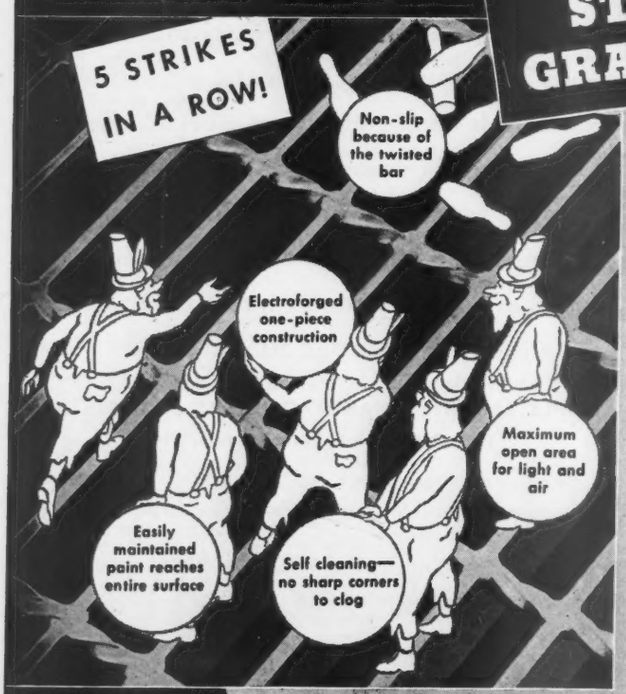
FEDERAL

PRECISION MEASURING INSTRUMENTS

*Chicago • Cleveland • Detroit • West Hartford • Muncie*
*New York • Philadelphia • Pittsburgh • Rochester*



BLAW-KNOX STEEL GRATING


5 STRIKES IN A ROW!
Non-slip because of the twisted bar
Electroforged one-piece construction
Maximum open area for light and air
Easily maintained paint reaches entire surface
Self cleaning—no sharp corners to clog

FREE

Paper weight size sample . . . Just fill in and mail the coupon.

BLAW-KNOX DIVISION of Blaw-Knox Co.
Farmers Bank Bldg., Pittsburgh, Pa.
SEND GRATING SAMPLE TO

Name _____
Street _____
City _____ State _____


then, to study operations, speed up the flow of work, and eliminate any bottlenecks.

One thing we discovered was the following situation:

One part, after being buffed, was placed in trays made of wood and wallboard and transported to the degreaser. At the degreaser the parts were transferred from the trays into a degreasing basket. After degreasing, the parts were transferred again from the degreasing basket into the trays, after which the parts were once more transported back to the polishing room. We immediately spotted this as a place where handling time could be saved.

The solution of this wasted time problem lay in a wire tray that would also serve as a degreasing basket. A handle was designed that would accommodate a number of wire trays at a time, so that it would be possible to degrease an appreciable quantity at the same time.

Now, after buffing, the parts go into the wire trays; these wire trays are transported to the degreaser. No transferring of any kind is necessary, the wire trays going right into the degreaser. After the degreasing operation, the parts, still on the wire tray, are transported to the press room for the next press operation. Since it is necessary for the press operator to handle each part separately anyway, this time, instead of replacing the part in the wire tray, he puts it into one of the regular trays after completing his operation. The wire trays then go back to the polishing room to start the trip again.

•

**In those places where conventional methods of joining parts could be replaced, use of selftapping screws has enabled duplicating machine manufacturer to cut assembly costs from 25 to 40 percent.**

•

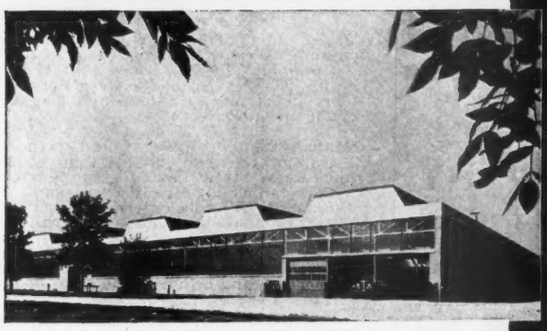
### Die-Cast Cover Plate Saves $8,730

SOURCE
Harvill Aircraft Die Casting Corporation, Los Angeles

A diesel-engine cover plate die-cast for Menasco Manufacturing Company, Los Angeles, is 30 inches long, 8 wide, 5½ deep. Based on a production of 3,000 parts, this company found it could save $8,730 over any other method of fabrication.

Add to the above a substantial amount saved because the part needs little machining, thus relieving machine-shop congestion in Menasco's plant. Parts are smooth, uniform, interchangeable in assembly.

# COAL
## THE MODERN FUEL
### FURNISHES ECONOMICAL HEAT & POWER FOR NASH MOTORS' NEW $7,000,000 PRODUCTION SET-UP



This new section of Nash's Kenosha, Wisconsin, plant represents a part of the $7,000,000 expenditure for production revamp.

Here's a big, modern manufacturing plant on paper! This photograph shows Nash plant engineers checking the layout of 14 miles of production and conveyor lines, prepared to make the "Nash Ambassador 600"—newest contender in the low-price car field.

● In the great majority of plants, where complex equipment is geared to tight production schedules, you find the modern, *dependable* fuel—COAL. Nash is in line with the leaders, relying on coal to give them unfailing power and heat at minimum maintenance and steam costs.

Coal is a "flexible" fuel . . . able to do an *economical* job for plants of every size. Perhaps, as in so many cases, Chesapeake and Ohio's Fuel Service Engineers can show *you* the way to greater operating reliability at lower fuel cost. The services of these trained engineers are free of charge. And if you have a job for a specific kind of coal, we can help still further. This railroad serves "The Coal Bin of America," where the mechanized mines of these great bituminous fields can uniformly prepare coal to exact specifications, as to B. T. U., ash softening temperature, high or low volatility, grindability.

**For information or assistance with your fuel problems, write GEORGE H. REINBRECHT, Coal Traffic Manager, Chesapeake and Ohio Lines, 2908 Terminal Tower, Cleveland, O.**

# CHESAPEAKE AND OHIO LINES

# REDUCE METAL TURNINGS

## TO UNIFORM SIZE

*With*

## JEFFREY CRUSHER

**ADVANTAGES:**

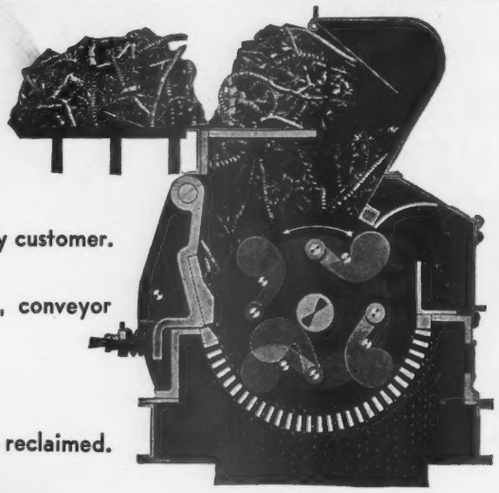
Uniform size chips preferred by customer. Bring a better market price.

More easily handled — shovel, conveyor or magnet.

Greatly reduces volume.

More tonnage per car.

Oil or cutting compound easily reclaimed.



(Patented)

Cross-section of Jeffrey steel turnings crusher above. At the left may be seen two types of steel crushing elements, the cloverleaf and the Flextooth. Furnished with top feed or side feed.

***Our Reduction Division will be glad to go into details***

## THE JEFFREY MANUFACTURING COMPANY

**911-99 North Fourth Street, Columbus, Ohio**

| | | | |
|---|---|---|---|
| New York | Pittsburgh | Cleveland | Terre Haute |
| Boston | Scranton | Detroit | Milwaukee |
| Buffalo | Huntington | Chicago | Salt Lake City |
| Philadelphia | Cincinnati | St. Louis | Denver |
| | Birmingham | Houston | Baltimore |

## Equip Your PRESENT MACHINE TOOLS for DOUBLE PRODUCTION

## *At Small Cost*

**There are two ways to speed up production of steel parts for use in armaments and auxiliary equipment required by the emergency National Defense program.**

**The first is to acquire more floor space and install new machine tools, a time-consuming and obviously expensive method.**

**The second way is to install KENNAMETAL-tipped tools on your present equipment. This is by far the most practical and economical way of speeding up production, for KENNAMETAL cuts steel at 2 to 6 times greater speeds and combines roughing and finishing in one cut. It doubles the output of equipment already in use. The cost of KENNAMETAL tools is insignificant as compared to the cost of new machinery, and they can be put in operation almost overnight.**

**Do your share to speed up National Defense—investigate KENNAMETAL without delay. You cannot afford to waste time—a National Emergency exists. Write, wire or phone today for a free survey to show how KENNAMETAL can double your production of steel parts. No obligation—act now!**

KENNAMETAL *Steel-Cutting* CARBIDE TOOLS

McKENNA METALS Co.

130 LLOYD AVENUE

LATROBE, PENNSYLVANIA, U.S.A.


## BOOKS

### TRENDS IN INDUSTRIAL PENSIONS

Murray Webb Latimer, Chairman of the Railroad Retirement Board, and Karl Tufel. Industrial Relations Counselors, Inc., RKO Building, Rockefeller Center, New York. 88 pages, 26 tables. $1.

Analyses of 347 active voluntary pension plans established or revised between May 1, 1932, and December 31, 1938, constitute a continuation, in some respects, of *Industrial Pension Systems in the United States and Canada*, 1933. (It omits railroad pension plans and plans of Canadian companies.) Objectives: To determine whether or not characteristics and trends of seven years ago have persisted and, if not, the direction of any new tendencies; to analyze growth or decline and present extent of the voluntary pension movement; to consider, in view of governmental social insurance measures, the adaptation of private pension plans to governmental old-age insurance legislation. Twenty-six appendix tables summarize significant features of the plans, compare benefit rates and amounts, present certain phases of financial experience.

### WHAT THE BUSINESS MAN SHOULD KNOW OF THE LABOR LAW AND ITS ADMINISTRATION

J. Raymond Tiffany, General Counsel; Benjamin Werne, Editor, *Annual Survey of Economic Legislation*. J. Raymond Tiffany, 28 West 44th St., New York. 64 pages, index, 50c, single copy; 25c each for 250 or more.

Management, its rights and responsibilities, is the subject of this booklet which says, "It is time for management to take stock of itself, refuse to be intimidated into the absolute surrender of its franchise and abdication of all control over its own business." How management should protect itself against unfair employee practices in order to preserve its rights is also discussed.

### MODERN FOREMANSHIP AND SUPERVISION UNDER NEW DEAL LEGISLATION

Harvey B. Rector and W. A. Rinckhoff. Law Research Service, 712-14 Keith Building, Cincinnati. 156 pages. $4.50.

Course for training foremen and supervisors to perform their duties in compliance with New Deal legislation uses common shop terms and everyday language to analyze the complications arising under the NLRA (Wagner Act), The Fair Labor Standards Act (Wage and Hour Law), and The Walsh-Healy Act. Object is to educate supervisors and foremen so that they will not make those labor relations mistakes which prove costly to employers. Organizational procedures and tactics and collective bargaining are discussed, chart of unfair labor practices is included.

### BUSINESS REPORTS

Alta Gwinn Saunders, Professor of Business English, Chairman of Division of Business English, University of Illinois; Chester Reed Anderson, Associate Professor of English, University of Illinois. McGraw-Hill Book Co., Inc., 330 West 42d St., New York. 468 pages, graphs, bibliography, index. $3.50.

Second edition, a new treatment of principles and procedure of report writing and research technique in business. The emphasis is on investigation and presentation. A single basic plan underlying all types of reports is set up. The latest theories in research methods, sampling, questionnaire technique, and in the making of charts and graphs are included. Annual company and municipal reports receive considerable attention.

### DISMISSAL COMPENSATION

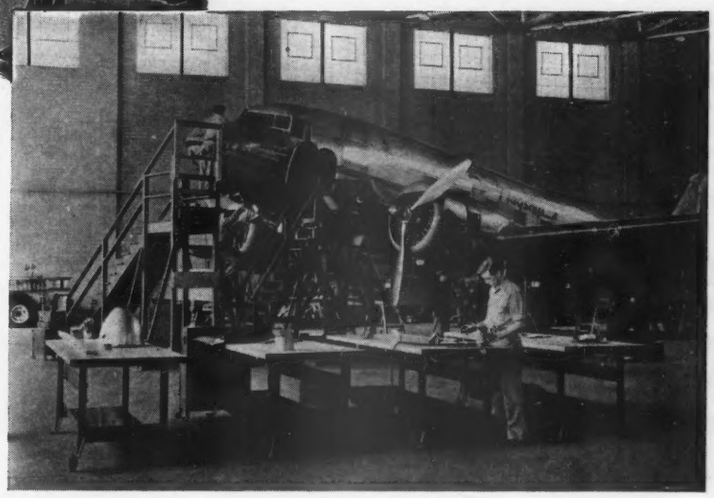
Everett D. Hawkins. Princeton University Press, Princeton, N. J. 390 pages, tables, bibliography, index. $4.

Company executives and labor leaders may well put this study of voluntary and compulsory dismissal compensation plans in the United States and abroad on their reading lists. It deals with company and trade-union plans; considers growth, compensation provisions, administrative prob-

# "Hallowell" Benches

Fig. 732
Pat'd. and
Pat's. Pend.
Drawer is extra

# make it easier



AMERICAN Airlines hangar at LaGuardia Field, N. Y., chose semi-portable "Hallowell" Benches with attractive laminated wood tops—four of them are shown in picture above. These are easily pushed from job to job, saving steps, time and money.

No matter how special your bench requirements, there's always a ready made "Hallowell" to fill the specifications. And by ordering "Hallowell" Benches, you eliminate the costly time and trouble of lay-out, and buying a raft of lumber . . . and you get a better, more durable bench in less time and probably at less cost!

And last but not least—the "Hallowell", unlike most other benches, is so robust and rigid that it does not need to be bolted to the floor—a tremendous saving and convenience.

**STANDARD PRESSED STEEL CO.**

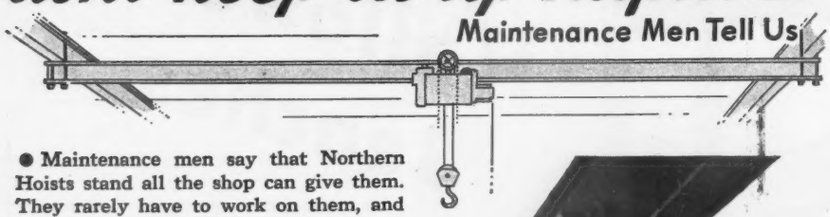
JENKINTOWN, PENNA. BOX 546

— BRANCHES —

BOSTON • DETROIT • INDIANAPOLIS • CHICAGO • ST. LOUIS • SAN FRANCISCO

# "Northern Hi-Lift Hoists *don't keep us up nights"...*

**Maintenance Men Tell Us**



● Maintenance men say that Northern Hoists stand all the shop can give them. They rarely have to work on them, and when they do, accessibility makes it easy.

Northern Hi-Lift Hoists are built to forestall maintenance. Liberal design—robust construction—welded rolled steel frame—machine cut, heat treated alloy steel gears—Hyatt Roller bearings. But when maintenance *is* needed, all parts are quickly accessible. Mechanical brake parts, for example, can be removed without removing the gear case. Electrical parts are all standard—easy to obtain.

*Write for new Bulletin*

**NORTHERN ENGINEERING WORKS**
**2613 ATWATER ST. DETROIT, MICH.**

**CRANES *Northern* HOISTS**

LIKE THE AUTO INDUSTRY . . . where Ross Oil or Gas Fired Air Heater Systems have achieved remarkable efficiency and major economies. If your product involves heating, baking, drying, or finishing, it will pay you to consider the use of AIR at any temperature up to 1000° F.

*Descriptive Literature*

Write for our bulletins on Ross Air Heating Systems; how they increase quality and quantity of output, save fuel and floor space. No obligation.

**J. O. ROSS ENGINEERING CORP.**
**350 MADISON AVENUE, New York, N. Y.**

201 N. Wells Street, CHICAGO
408 Empire Building, PITTSBURGH, PA.
12953 Greeley Avenue, DETROIT


lems, results, limitations and trends, foreign and American legislation; and discusses the value of a dismissal compensation program when employment decreases from a wartime peak. The final chapter summarizes and compares various types of experience and relates the problem of dismissal compensation to technological unemployment.

### PRACTICAL BUDGET PROCEDURE

John H. MacDonald, Budget Officer, National Broadcasting Co. Prentice-Hall, Inc., 70 Fifth Ave., New York. 326 pages, graphs, forms, bibliography, index. $4.

To answer the question, who does what and how, the author discusses in each chapter the particular principles of budget procedure followed by certain companies and then describes the methods pursued with sufficient detail to illustrate the application of the principles under discussion. Particular attention is given to the management aspects of budgetary control. The accounting aspects, especially as they concern cost accounting and manufacturing expense, are also covered.

### INFORMED LEADERS FOR BETTER INDUSTRIAL RELATIONS

Silver Bay Industrial Conference, 347 Madison Avenue, New York. 133 pages, illustrations. 75c, single copy; 50c each for 10 or more.

Summary of the proceedings of the Silver Bay Industrial Conference of 1940, Silver Bay-on-Lake George, New York, contains in abridged form such topics discussed as management's responsibility in industrial relations; mediation, conciliation, and arbitration; amount of wage labor is entitled to; labor's and management's responsibilities to the public, public's concern in industrial relations; future of management. Sectional conferences included talks on foreman training, methods of employee rating, fundamentals of the collective contract, training of skilled workers, health programs, determining employee attitudes.

●

## ON THE CALENDAR

### DECEMBER

**2–4,** American Institute of Chemical Engineers, Annual Meeting, New Orleans. Stephen L. Tyler, Secretary, 50 East 41st St., New York.

**2–6,** American Society of Mechanical Engineers, Annual Meeting, New York. C. E. Davies, National Secretary, 29 West 39th St., New York.

**2–7,** Fourteenth National Exposition of Power and Mechanical Engineering, New York. Charles F. Roth, President, International Exposition Company, Grand Central Palace, New York.

**5–6,** Society for the Advancement of Management, Annual Meeting, New York. Miss Evelyn Buckley, Secretary, 29 West 39th St., New York.

**11–13,** National Association of Manufacturers, Annual Meeting, New York, Noel Sargent, Secretary, 14 West 49th St., New York.

### JANUARY

**6–10,** Society of Automotive Engineers, Annual Meeting, Detroit. John A. C. Warner, Secretary and General Manager, 29 West 39th St., New York.

**11–13,** American Engineering Council, Annual Meeting, Washington, D. C. Col. L. B. Lent, Secretary, 919 17th St., N. W., Washington, D. C.

**27–31,** American Institute of Electrical Engineers, Winter Convention, Philadelphia. H. H. Henline, Secretary, 33 West 39th St., New York.

### FEBRUARY

**17,** National Electrical Manufacturers Association, Midwinter Meeting, Chicago. R. J. Blais, Convention Manager, 155 East 44th St., New York.

### MARCH

**24–29,** American Society of Tool Engineers, Machine Tool and Progress Exhibition, Detroit. Ford R. Lamb, Executive Secretary, 2567 West Grand Blvd., Detroit.

# A *LOT* OF PRESSURE ON A *LITTLE* SPOT

IF YOU could look into your gear cases while the gears are moving, you'd find a situation much like the one above. The convex surfaces of your gear teeth offer but a minute line of contact—and all the power of your engines tries to push them together.

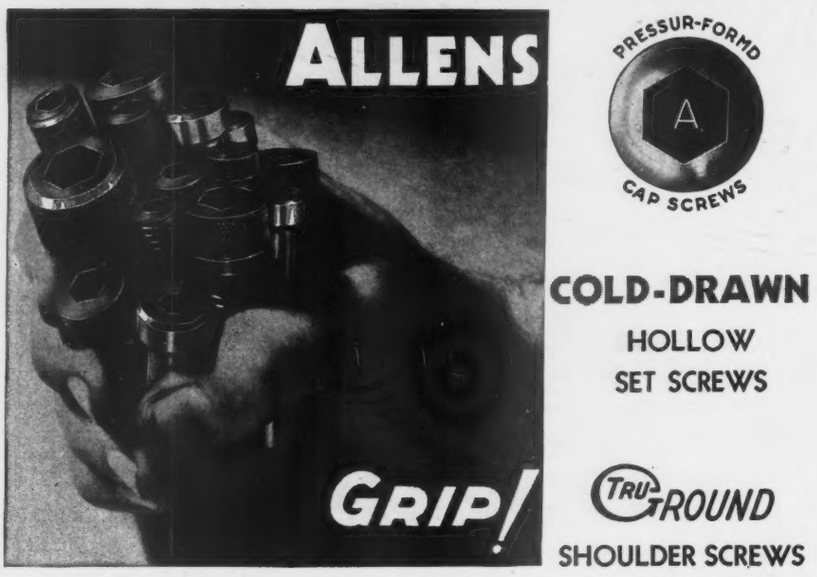
And what keeps those metal surfaces safely apart? Just a thin film of lubricant, which has to be absolutely right for each job if it's to give those gear teeth the long life the makers built into them.

Your Shell man can help you select the right lubricant for this exacting job. He's had a wide first-hand experience with spur gears and helical gears, worm gears and herringbone gears . . . every kind of gear doing every kind of work. In recommending a gear lubricant, he always aims at two objectives: *The longest possible life for the gears. The least possible loss of power.*

***Call in your Shell man today —let him start insuring a smooth life and a long one for your gears.***

**SHELL** INDUSTRIAL LUBRICANTS

IDLE TIME!
CAN YOU MEASURE THIS "PROFIT LEAK" Exactly —FOR EVERY MACHINE?
The Little Servis Recorder Tells You When Each Machine Stood Idle—and How Long!
All delays are shown up, automatically. This "down time" stares out at you from its chart (see below). And you bet it gets attention!
How to get this kind of record? Merely bolt or clamp on a Servis Recorder. Then your machine writes its own story...how busy, when idle and how long, etc. Often leads to enormous savings! Write for folder—"A Busy Plant." THE SERVICE RECORDER COMPANY, 1375 Euclid Ave., Cleveland, Ohio.
Here's a Stop of 2 Hours
POINTS OUT ALL DELAYS
The Servis Recorder
The "Time Clock" for Machinery




MANAGEMENT'S grip tightens on the tools of production; engineers bear harder on speeds and stresses; machines are racked by the reckless strains of emergency operations.

But *ALLENS* HOLD. They are "steeled" to hold, threaded to hold. hardened to hold. The technical history of their development is three decades of TESTS — *duplicating emergency conditions.*

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THE ALLEN MANUFACTURING COMPANY
HARTFORD, CONNECTICUT, U. S. A.


## They Say and Do

### December 26 Is Deadline for Alien Registration

Only the month of December remains—December 26 is the deadline—for aliens to register or become liable to the penalties the Alien Registration Act provides for failure to record alien status.

The wide attention and publicity given to Selective Service registration may have caused some individuals to confuse requirements of the two laws. To clear up such misunderstanding, Earl G. Harrison, Director of Alien Registration, points out that "male aliens of draft age who registered under Selective Service are also required to register under the Alien Registration Act."

Employers are urged to check their payrolls and help their non-citizen employees avoid, by registering before December 26, the penalties of $1,000 fine or six months' imprisonment, which the law provides for failure to register.

### Electric Truck Bookings Reflect Defense Activity

October bookings of electric industrial trucks and tractors were substantially higher than any previous month during the year, figures compiled by the Industrial Truck Statistical Association, 208 South LaSalle Street, Chicago, indicate. There were 193 units booked, compared with the previous high in September of 154 units.

Total net value at factories for chasses only was $653,682.20, compared with the previous high in July of $591,784.44.

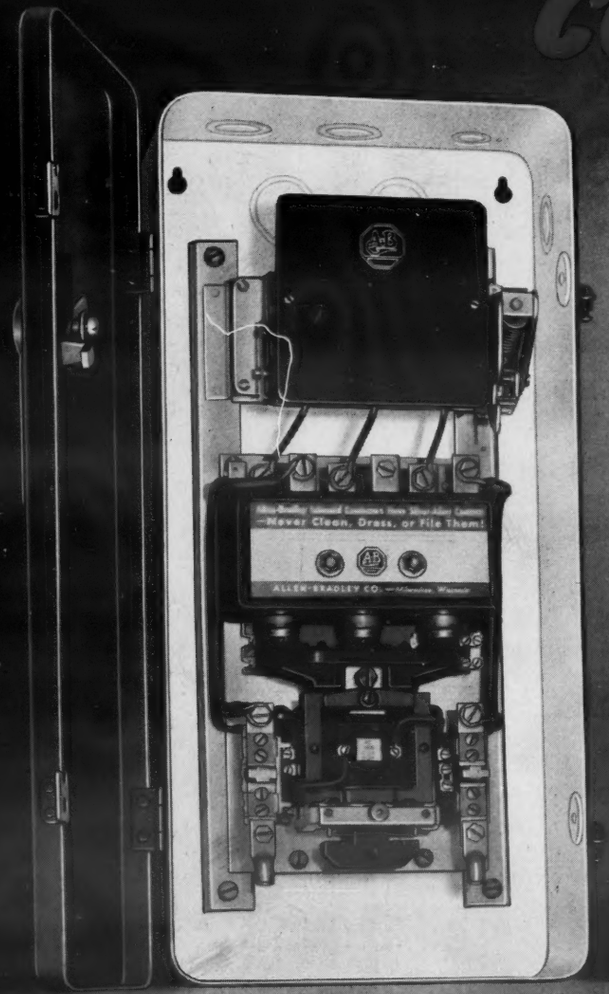
There were 22 non-elevating platform trucks with capacities and chasses base prices ranging from 2,000 to 6,000 pounds, and $1,615 to $1,995, respectively, with a total net value at factories of $41,974. Net values shown are after additions and deductions for variations from standard specifications, trade-in allowances, etc., if applicable.

One hundred forty-seven cantilever trucks, capacities and base prices ranging from 1,000 to 20,000 pounds, and $1,300 to $7,860, respectively, had a total net value of $505,192; 8 tractors, capacities and base prices ranging from 475-2,000-lb. to 600-3,000-lb. drawbar pull, and $1,550 to $1,745, respectively, had a total net value of $13,541; 15 crane trucks, capacities and base prices ranging from 3,000 pounds at 7-ft. to 10,000 pounds at 5½-ft. radius, and $4,980 to $7,450, respectively, had total net value of $89,675.20; and one special non-load carrier truck had total net value of $3,300.

# COMBINATION STARTERS

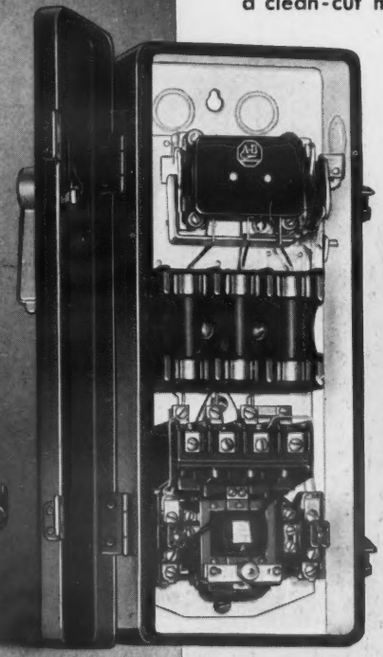
## Designed for TROUBLE-FREE Service

**BULLETIN 712** Combination Starters—comprising a disconnect switch and automatic starter in one cabinet—have been redesigned for even greater sales appeal. The disconnect switch lever on the front of the cabinet presents a clean-cut modern appearance, and the more compact disconnect switch provides additional wiring room. Nothing has been taken from the reliability of the former construction.



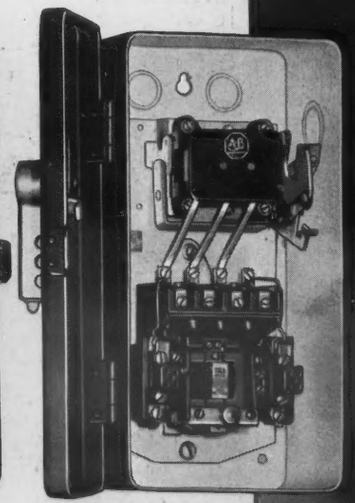

Size 3—Maximum polyphase rating: 30 hp, 220 v; 50 hp, 440-550 v.

Size 2—Maximum polyphase rating: 15 hp, 220 v; 25 hp, 440-550 v.



Size 1—Equipped with fuse clips. The felt gasket seal used with Type 1A enclosure effectively keeps out dust.

Size 1—Maximum polyphase rating: 5 hp, 220 v; 7½ hp, 440-550 v.



Size 0—Maximum polyphase rating: 1½ hp, 110 v; 2 hp, 220-440-550 v.

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## SOLENOID MOTOR CONTROL

# For those TOUGH Jobs—

## use Motor Control that's TROUBLE-FREE!



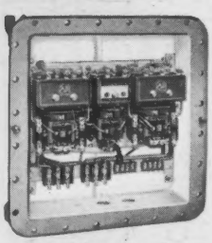
**Hand-Operated Starters**
Bulletin 609—A quick-action manual switch for across-the-line motors. Push-button control and overload protection.



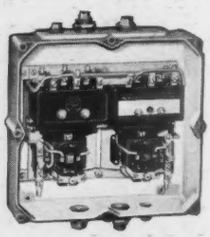
**Across-the-Line Starters**
Bulletin 709—For starting squirrel cage motors. Simple, reliable solenoid construction.



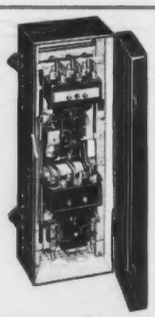
**Combination Starters**
Bulletin 712—A solenoid starter with a manual disconnect switch in one enclosure.



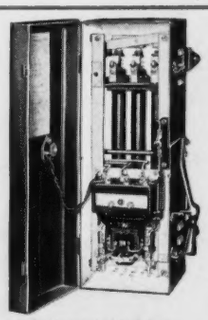
**Multi-Speed Starters**
Bulletin 715—For two, three, and four-speed across-the-line motors. Solenoid construction.



**Reversing Switches**
Bulletin 705—For reversing squirrel cage motors. Provides rugged solenoid reliability.



**Reduced-Voltage Automatic Starter**
Bulletin 740—Provides smooth motor acceleration without violent inrushes of line current.



**Reduced-Voltage Manual Starter**
Bulletin 640—For velvet-smooth acceleration of squirrel cage induction type motors.

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SOLENOID MOTOR CONTROL

QUALITY

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**5 BEARINGS**—Classification of bearings according to various weights of fighters known to the boxing ring puts the bearings into the Flyweight Class—Series 100, the Welterweight Class—Series 400, the Middleweight Class—Series 500, the Heavyweight Class—Series 600, Alternate Heavyweight Class—Series 7,200. Folder 1846 describes these bearings. Link-Belt Co.

**6 BELTING PROBLEMS**—Purpose of a comprehensive handbook is to help you with your belting problems and to show you general applications which can be handled satisfactorily with Tannate Watershed Flat Leather Belting. Specifications and characteristics of the belting, determination of pulley diameters and shaft speeds, making belts endless, belt maintenance, pulleys and pulley alignment are among the subjects covered. J. E. Rhoads & Sons.

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On many maintenance and production jobs, you can save time, ease the work and cut costs by using this handy truck-mounted STOW model—any place in your plant or yard. It's a glutton for work—because STOW's 65 years' experience with flexible shafting guarantees unusual ruggedness and power capacity. Here's an all-around machine that can pinch-hit or do steady-duty with equal reliability. It will be a maximum earner for you—one you can't afford to be without in these days when every job is RUSH.

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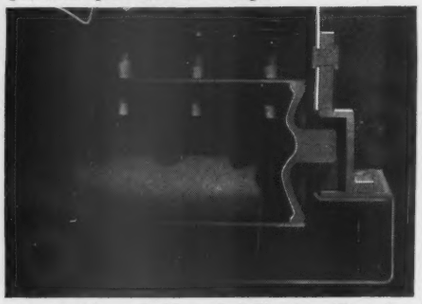

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and harden and fill its surface. Applications are shown, prices are quoted. Magnus Chemical Co., Inc.

**9** **CLUTCHES**—Construction details and application of the clutches to sweeper attachments, gear trains, ram-type turret lathes, automatic screw machines, pipe-threading machines, grinders, gear case of hoist, trucks are described and illustrated in a 23-page booklet that includes ratings and dimension diagrams. Rockford Drilling Machine Division, Borg-Warner Corp.

**10** **CUTTING STEEL**—Chart 5 lists hp. requirements for cutting soft and hard steel with Kennametal-tipped tools. Purpose is to enable the tool supervisor to advise the machine operator what depth and feed the machine will pull in cutting steel with Kennametal tools. McKenna Metals Co.

**11** **DISTRIBUTION SYSTEMS FOR LIGHT AND POWER**—Feeder Busduct, Plugin Busduct, Plugin devices and accessories are the subject of Bulletin 61. Construction, enclosures, dimensions, conductors, specifications are outlined. Prices are listed and installations illustrated. Frank Adam Electric Co.

**12** **ELASTIC PRIMER**—Directions for its use, how it prevents rust, reports from users, other products are outlined in Bulletin 8-2. American Chemical Paint Co.

**13** **ELECTRICAL CONTROL EQUIPMENT**—September 1940 Catalog contains the addition of several new lines—the MH Multi-Breaker power panel; the motor control centers; the addition of 3-phase, 4-wire, 100-amp., M-2 Multi-Breakers. Regular line of switches, service equipment, controllers, switch and fuse panelboards, etc., are listed with ratings, sizes, prices. The Trumbull Electric Mfg. Co.

**14** **ELECTRICAL EQUIPMENT FOR PAPER INDUSTRY**—Covering everything from power generation to the smallest auxiliary drive and control, Book B-2221 is composed of six sections dealing with a history of electrical application; information on power, pulp and paper-making equipment, paper machine drives, paper finishing machine drives, miscellaneous equipment. The paper used in the book shows what can be done with the finest grades. Stiff cardboard cover features embossed design. Westinghouse Electric & Mfg. Co.

**15** **ELECTRIC LAMPS**—Bulletin M-9 describes the company's Special Edison Electric Lamps—permissible hand lamps and trip lamps, special hand lamps, mule or cage lamp. Rectifiers for charging Edison mine-lamp batteries are also mentioned. Mine Safety Appliances Co.

**16** **ENDLESS BELTS**—Drive data book lists standard sizes of two styles of Whipcord Endless Flat Belts said to be capable of handling drives from ¼ to 25 horsepower. Also lists drives of various types available with these standard stock belts. The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc.

**17** **FAN BLAST UNITS**—Are designed to meet any need for heating units, tempering units, preheaters, reheaters, booster units for use in air-distributing

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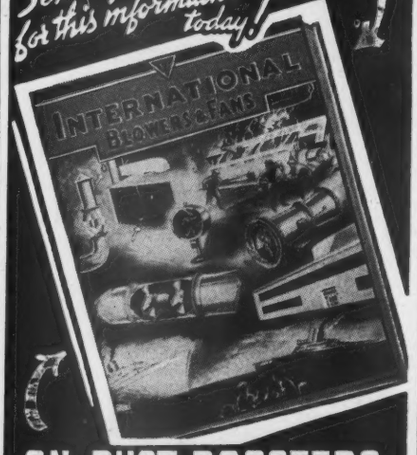


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systems. Various types are illustrated and their features are pointed out. Catalog 4540 also contains final temperatures and condensation tables, application-of-performance graphs, water-velocity tables, catalog numbers, piping diagrams. Young Radiator Co.

**18** **FINISH BAKING AND DRYING OVENS**—Pictorial bulletin No. 51 presents ideas on a line of ovens for finish baking and drying and makes suggestions on modernizing present equipment. Typical installations are illustrated. Despatch Oven Co.

**19** **FIRE-FIGHTING APPARATUS**—Complete line of equipment—fire extinguishers of various types, tanks, pails, foam systems, firemen's accessories—is presented in a 57-page booklet. M. L. Snyder & Son.

**20** **FIRE HOSE**—For mill, office, and plant protection is described in Catlog Section 3750 which contains data on single-jacket and double-jacket hose, rubber-covered hose, fittings of Koroseal. Illustrated. The B. F. Goodrich Co.

**21** **FLEXIBLE LIGHT AND POWER CIRCUITS**—For industrial plants and commercial buildings. 44-page booklet describes a flexible distribution system, explains how new circuits may be added to the system at will or how old circuits may be moved to new machine locations. Profusely illustrated with pictures of applications, diagrams. BullDog Electric Products Co.

**22** **FLEXIBLE VARNISHED TUBING**—The "unvarnished truth about flexible varnish tubing" is told in a recent folder that points out its features. William Brand & Co.

**23** **GRATING, FLOORING, STAIR TREADS**—Diamond grating, steel stair treads, Hexteel heavy-duty surface armor, Acme Floorsteel are described in a recent catalog that includes tables of safe loads, information on assembly and recommended fillers. Photographs and diagrams show various services and methods of using the company's products. Wm. F. Klemp Co.

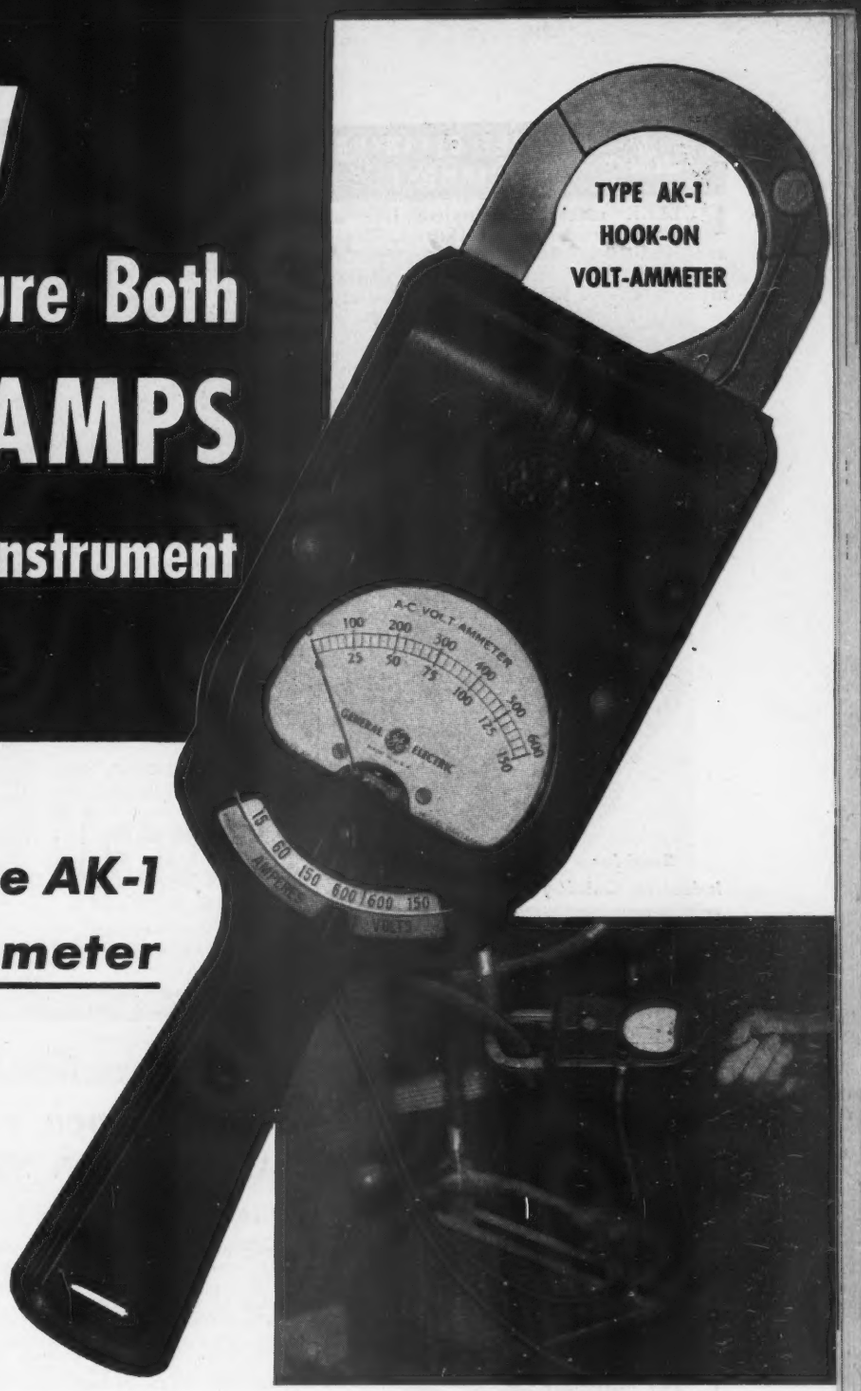
**24** **GROUP-WASHING EQUIPMENT**—1941 catalog contains 36 pages of illustrations and information regarding washfountains, multi-stall showers, drinking fountains. Specification data and washroom planning suggestions are included. Bradley Washfountain Co.

**25** **HOISTS**—Line of hoists—ratchet-lever, pushbutton-control, safety-pull, chain, and electric hoists—is described and features are pointed out in Catalog G-3 which illustrates the various types; contains specifications and prices; gives information on safety-load, binder, and chain-hoist parts. Coffing Hoist Co.

**26** **HOSE**—Gasoline hose is the subject of one folder that points out how to save on every gallon. Twin-Weld hose is described in a second folder that explains its advantages in welding. Hewitt Rubber Corp.

**27** **"HOW TO SEAL CORRUGATED SHIPPING BOXES"**—Is a handy guide to correct sealing. Topics discussed include sealing with adhesives,

# NOW
# You Can Measure Both VOLTS and AMPS with a "Hook-on" Instrument




## *That's Why We Call the AK-1 A Hook-on Volt-ammeter*

IT'S no trick at all to measure both alternating current and voltage with it. All you do is hook the instrument around the line and read amperes. Then connect the leads to the binding posts and read volts.

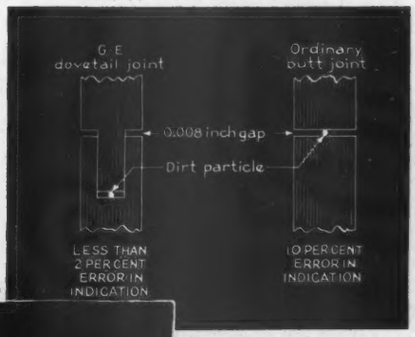
### No Additional Equipment Needed

You don't need a separate transformer, voltmeter, or any other additional equipment. And you don't need to cut conductors or shut down equipment to make your measurements.

### One Setup to Measure Current and Voltage

After measuring voltage, leaving the leads connected does not affect hook-on current readings. Just flick the selector switch to either "Amperes" or "Volts" according to the measurement you want.

**Our bulletin GEA-2950 describes the AK-1 in detail, and illustrates how easy it is to use. Order a copy from your nearest G-E Office, or write General Electric, Schenectady, N. Y.**




### Special Dovetail Joint Assures Consistently Accurate Readings

**The hook that closes around the conductor has a dovetail joint which minimizes errors caused by unnoticed dirt lodging between the jaws of the instrument. Particles of dirt which would cause large errors in the ordinary butt joint have almost negligible effect on the readings obtained with the AK-1.**



### For Emergency and Maintenance Testing

**This instrument is particularly handy for quick, accurate measurements when you have trouble with electric equipment and need the answer to circuit conditions in a hurry. Also, you will find it very useful for checking the loading of motors, and for other routine maintenance measurements.**

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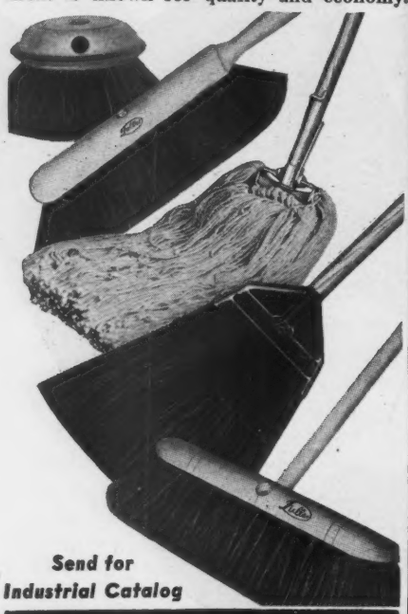
FULLER makes a complete line of Brooms, Brushes, Mops, Dusters, Waxes and Polishes. In factory, warehouse, shop and office Fuller Cleaning Equipment is known for quality and economy.



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Staff Supervisor, Time Study and Methods, Westinghouse Elec. & Mfg. Co.

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From this book you can get everything necessary to develop a system that may be applied in any industry, using simple and inexpensive apparatus, securing quick results, and operating with minimum interference with production and workers' mental attitudes.

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—functions of time and motion study
—scientific fundamentals
—what make a good time-study man
—equipment and how to use it
—how to make observations
—how to analyze the results
—how to standardize jobs, and set up formulas, etc.

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Especially important in this edition is the greatly enlarged section on motion study, giving many details on analyzing the process and operations, eliminating unnecessary work and motions, and installing simple, practical work-reducing methods.

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gummed tape, metal staples or stitches, metal straps and wires. Second edition. The Hinde & Dauch Paper Co.

**28** **INTERCOMMUNICATING SYSTEMS**—48-page catalog covers various types of private intercommunicating systems and special instruments such as elevator, portable, and boiler-room phones. The major systems and optional variations are described, wiring diagrams and installation data are included. Bulletin 103, bound or loose-leaf form. Connecticut Telephone & Electric Corp.

**29** **MAGNETIC MOTOR STARTERS**—Across-the-line type. Detailed description and general information on a line of starters are contained in Bulletins 504 and 504-S. The starters are illustrated and the bulletins include specifications, prices, ordering information, cabinet and interior dimension diagrams. Colt's Patent Fire Arms Mfg. Co., Electrical Division.

**30** **MAINTENANCE PAINTING HANDBOOK**—First section is devoted to preparation of various types of surfaces and correct paints to employ. Conditions to which painted surfaces are subjected are analyzed in the second section. General section contains information concerning drying times of various paints. Break-down analyses of products are included in the final section. American Marietta Co.

**31** **MARKED AND MEASURED WIRE**—Dilec Safecote Wire, new types of building wires recognized by the 1940 National Electrical Code are discussed in booklet 433. Conductor insulations, current-carrying capacities, number of conductors in conduit or tubing, wire and cable dimensions and areas, conduit and tubing dimensions and areas are presented in table form. National Electric Products Corp.

**32** **"NO. 1 PLASTICS AVENUE"**—They call a handsome brochure containing color and black-and-white photographs of a variety of products made of plastics—Textolite compression molded, injection molded, cold molded, laminated, molded-laminated; lighting specialties, Parkwood Textolite. Also tells about six problems solved the G-E way. General Electric Co.

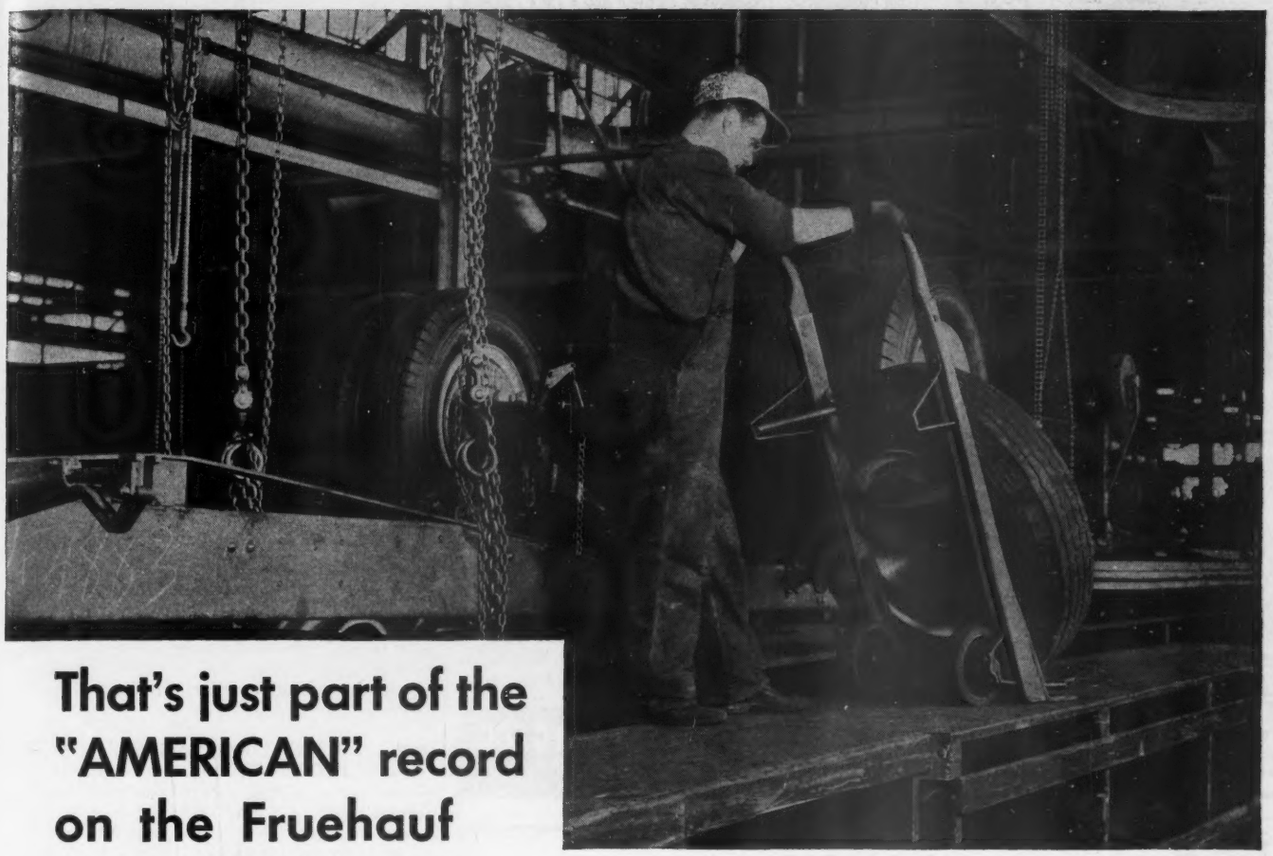
**33** **OIL CIRCUIT BREAKER**—Type FK-142, 25,000 kva., for circuit protection and motor starting. GEA-2165A points out the features that help to improve operation and reduce maintenance. Breaker combination for reduced-voltage starting is described. Dimensions, ratings, wiring diagrams are included. General Electric Co.

**34** **OUTDOOR OIL CIRCUIT BREAKERS**—Features, construction, methods of tripping, equipment included with breaker, automatic reclosing equipment are outlined and described in Catalog 3630. Breakers have 7,500-volt rating and 50,000-kva. interrupting capacity. Roller-Smith Co.

**35** **PILLOW BLOCKS**—Various types equipped with self-aligning radial-thrust roller bearings are illustrated, prices are listed, and the advantages of self-alignment are explained in Bulletin 526. Shafer Bearing Corp.

**36** **PIPE AND BOLT MACHINES**—Folder contains full information

# MAINTENANCE COST-ZERO



## That's just part of the "AMERICAN" record on the Fruehauf assembly line!

Building giant trailers for modern highway hauling is another job that calls for "American" Steel Hand Trucks.

For more than four years, a fleet of Americans has been more than equal to the tough service at the Fruehauf Trailer Company plant in Detroit. Today, these "American" Trucks are still as good as ever, and **maintenance expense to date has been zero!**

A typical example of an efficient handling operation is shown in the above photo where Americans "feed" the Fruehauf assembly line. In another department, Americans are used to handle large barrels of shackle pins — each full barrel a 900-pound load!

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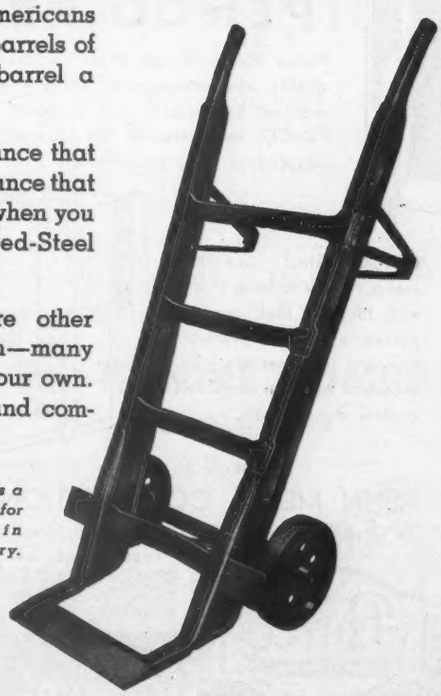
In the American files are other "case histories" by the dozen—many solving problems close to your own. Write for full information and complete catalog.



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**HAND TRUCKS**

**The American Pulley Company**
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UNION METAL STEEL TIERING SKID BOX

*Increases Storage Area*

★

*SPEEDS HANDLING*

● Need more storage room? You can have it at minimum cost by utilizing fully the wasted air space in your present storage areas.

Union Metal Tiering Skid Boxes may be handled speedily with power truck, hand lift truck or crane. Platforms are equipped with tiering angles which permit stacking to any height. Where tiering angles interfere with lift truck clearance, "Z" type brackets which fit over top of box are substituted.

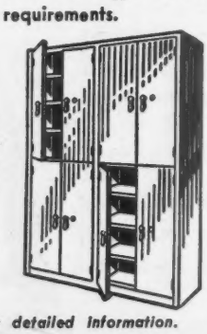
Complete line of corrugated steel skids, boxes and pallets also available. Write for catalog and address of nearest sales office.

THE UNION METAL MFG. CO.
CANTON, OHIO

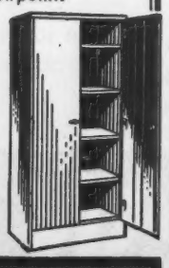
Profit *All Ways* with PENCO PRODUCTS

Penco Heavy Gauge Steel Lockers are synonymous with that extra quality and workmanship which means the utmost in space savings, reduced fire hazards and improved employee morale. Consult with PENCO engineers for the type of locker, cabinet or shelving best adapted to your requirements.

PENCO Steel Shelving makes it easy to keep stock and tools in their proper places, steps up production and increases the efficiency of material and tool control departments.



PENCO Steel Cabinets are designed in numerous sizes of storage and wardrobe combinations for the safe storage of personal apparel and materials. Widely acclaimed as satisfactory from every viewpoint.



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PENCO products are Steel Shelving, Cabinets, Lockers, Small Parts Bins, Tote Boxes, Shop Benches, Shelving Trucks, Steel Counters and Tables, Corrugated Metal Culvert Pipe and Metal Specialties.

1869 Penco FOR PERMANENCE

Fireproof Steel Products


and prices on pipe and bolt machines, portable and heavy-duty power units, pipe-threading tools. Catalog Section presents users comments. Various types are illustrated. Beaver Pipe Tools, Inc.

**37** **"PLANNED PROTECTION"** — Worried about sabotage or unwelcome prowlers? You will find some timely tips in a 4-page folder that contains a plant-protection check list that covers lighting, communication lines, electrical distribution. Various protection aids are suggested. Graybar Electric Co.

**38** **PLASTIC**—Properties of Plexiglas, applications, table of properties, discussion of Crystalite molding powders constitute the subject matter of a recent 43-page booket gotten together to serve as a guide to those engaged in design, production, and selling. Rohm & Haas Co., Inc.

**39** **PORTABLE FIRE-EXTINGUISHING EQUIPMENT**—Fire-Fog equipment for extinguishing oil and other flammable liquid fires is the subject of Bulletin 618A. How it acts on a fire is pictured. Spray Engineering Co.

**40** **POWER-CIRCUIT AIRCOOLED TRANSFORMERS** — Bulletin 401-PCT illustrates the various types, makes suggestions for applications, contains wiring diagrams and specification and dimension tables. Sizes 0.05 to 15 kva. in the double-wound type and 0.10 to 25 kva. in the auto-transformer type. Jefferson Electric Co.

**41** **PROTECTION AGAINST AIR-LINE FREEZING**—Bulletin R-16 points out the features of an anti-freeze that is said to protect air lines and air-operated equipment against temperatures as low as —70 deg. F. Equipment and installations are illustrated. Sullivan Machinery Co.

**42** **PROTECTIVE LIGHTING FOR INDUSTRIAL PLANTS**—The importance of lighting in protecting against sabotage and entrance by unauthorized persons as well as for night production is stressed in a 13-page pamphlet that features Wide-Spred lighting. Various types are discussed, horizontal and vertical light distribution curves are shown, installations are illustrated. Holophane Co., Inc.

**43** **PUMPS**—"For pumping everything but clear inactive liquids." Bulletin 940 tells all about a line of horizontal-shaft single-stage self-priming pumps and side-suction pumps, vertical-shaft shielded-bearing wet-pit inverted-unit pumps, vertical-shaft standard-bearing dry-pit pumps and wet-pit inverted-unit pumps. Characteristic operating curves are charted, construction and installation views are shown. American Manganese Steel Division, The American Brake Shoe & Foundry Co.

**44** **RECTIFIERS** — Bulletin Fl-3 explains the principle of the selenium dryplate rectifier and enumerates its characteristics and advantages. Recommended circuit arrangements are detailed and illustrated with wiring diagrams. Several types of complete rectifiers for battery charging and d.c. power supply, and numerous rectifier elements are described and illustrated. Fansteel Metallurgical Corp., Rectifier Division.

*(Continued on page 164)*

# Why so far into the Night?

CUT your conference costs. When you have a problem involving wire, call in the man from American Steel & Wire Company. He can offer you the experience that lies behind more than a century of answering problems concerning wire. You are free to call upon us for assistance which may result in the trouble-free production that produces a better product and bigger profits.

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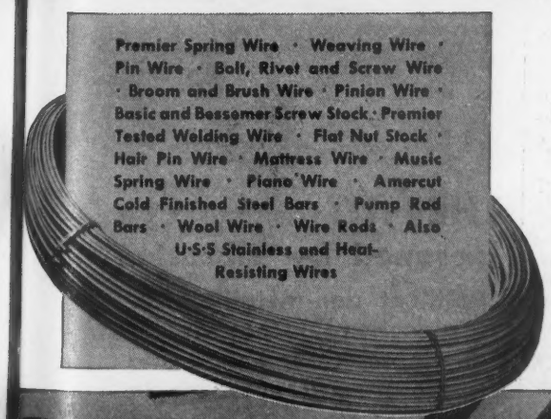
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(*Continued from page 162*)

**45** ROLLER CHAIN—Bulletin R-40 contains complete information on construction of channel-lubricated interchangeable roller chain, details of adaptations, selection of right chain for drives, performance data and engineering information. Also features illustrations and specifications of regular and special types of sprockets with recommendations for use. Price list for chains and sprockets is included. Morse Chain Co.

**46** SAFETY—Triple interlock safety guard designed to protect operators of stamping presses is featured in a bulletin that explains how it operates and what it does. A second bulletin instructs on stamping presses—their safety, uses, and abuses, and their maintenance and operation. Junkin Safety Appliance Co., Inc.

**47** SCREWS—Form 558 is a 16-page catalog presenting full information on Unbrako screws—socket and socket-head capscrews, self-locking and special screws, hollow setscrews, socket-head stripper bolts, keys and specials, square-head setscrews, self-locking nut. Each type is illustrated, prices and dimensions are listed. Standard Pressed Steel Co.

**48** SELF-ALIGNING COUPLING—The problem of misalignment is discussed; Fast's principle and design are outlined; lubrication, types of couplings and ratings, installation and operation, ordering information are included in an illustrated catalog. The Bartlett Hayward Co.

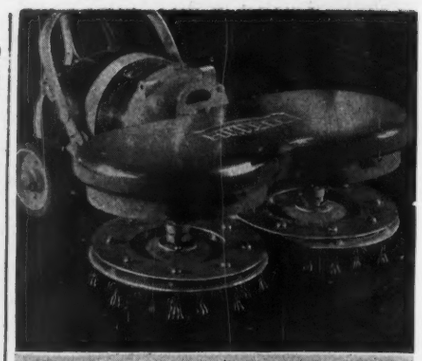
**49** SELF-PRIMING PUMPS—Information on the principle behind the pumps, the castings, construction and materials of construction, testing, various types, applications, use in hydraulic service is contained in a 7-page illustrated bulletin. The LaBour Co., Inc.

**50** SELF-REGULATING BATTERY CHARGERS—Four-page illustrated bulletin, No. 27-435, describes outstanding features of the Rectomatic battery chargers. General theory of operation is explained. Schematic diagram shows electrical circuit of the charger. Ratings, dimensions, mounting data for standard units are given in table form. Westinghouse Electric & Mfg. Co.

**51** SHIELDS—"Light Where You Want It—Plus Protection" is the title of a folder that features the adaptation of Marvel shields which direct light where needed and protect operators of such equipment as stationary grinders, disk sanders, surface grinders, band filers, shapers, metal band saws. Another folder shows how they help in removing splinters from eyes and hands when the shatterproof lens is exchanged for a magnifying lens. The Boyer-Campbell Co.

**52** SHOP BOXES AND STACK UNITS—An assortment of stacking boxes, shop boxes, tool boxes and tool stands, bench drawers, drill and reamer cabinets, taper pans, lockers is described in detail and illustrated in Catalog 184. Action photographs show the various types in use. All-Steel-Equip Co.

**53** SINGLE-BEAM CRANES—Overrunning and under-running types—push type, motor driven, hand racked, 2-motor and 3-motor bridge drive—are

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Clean floors mean more than improving the appearance of a place. Floors kept free from dirt, oil, grease, and other slippery substances are an important ally of safety.

Illustrated is a heavy duty *Finnell* designed expressly for hard-to-clean floors. Its two scarifying brushes dig through and completely remove embedded accumulations. Far better than the inadequate and costly hand-spud method.

Brush rings are removable—may be replaced with tampico or palmetto brushes and used for scrubbing, steel-wooling, waxing, or polishing floors.

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**THE NUT that can't be loosened by vibration**

Resilient non-metallic locking collar automatically eliminates thread play and holds thread surfaces in constant pressure-contact.

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ELASTIC STOP NUT CORPORATION
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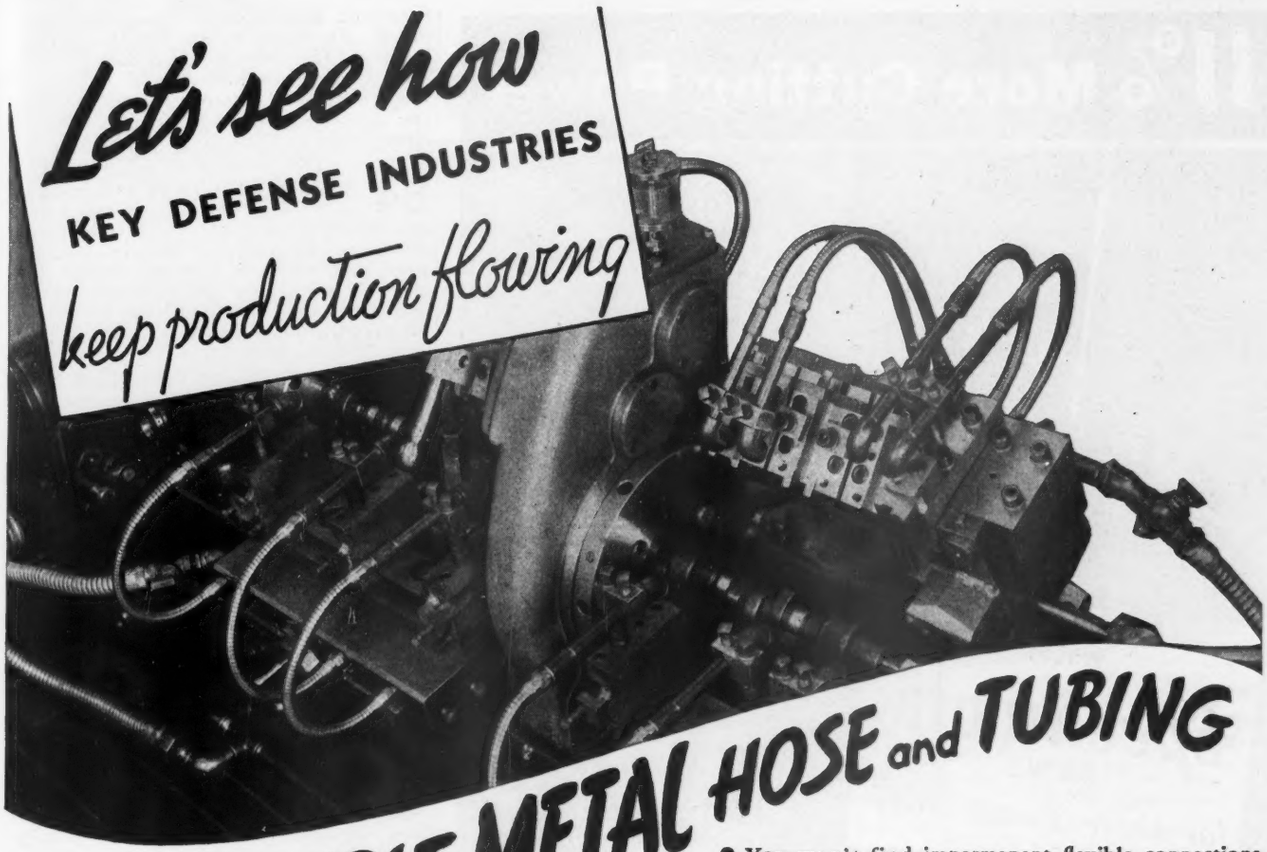
Elastic Stop SELF-LOCKING NUTS

# Let's see how KEY DEFENSE INDUSTRIES keep production flowing

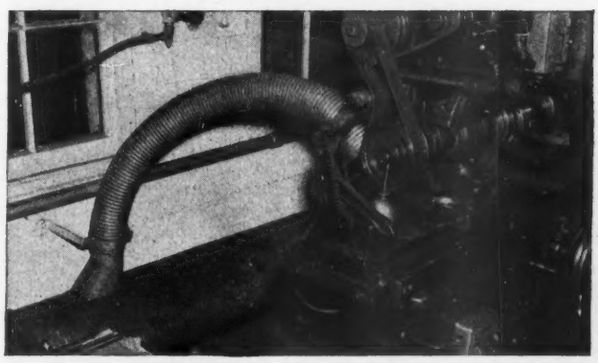


## with FLEXIBLE METAL HOSE and TUBING

● You won't find impermanent flexible connections on modern equipment that is now swinging into action for defense. Shut-downs for repair or replacement of oil, air or coolant feed lines can be so easily eliminated.

Note the many Flexible METAL Tubing sections that serve as coolant "arteries" on the modern machine tool illustrated above . . . they're easily adjustable, clean, normally good for the life of the equipment.

Perhaps there is a place in your plant, or on the equipment you make, where just such good qualities will help keep production flowing? Many types, many sizes, many metals are available for a practically unlimited range of uses. Send for your copy of our "Fact Book".



**GRINDER EXHAUST . . .** There's plenty of vibration, and lots of abrasive action in the grinding wheel chips that whizz through this Flexible METAL Exhaust Hose, but it's easily going to outlast previously used materials.

● A typical section of helically wound, interlocked, Flexible METAL Hose, showing the design of the joint and the position of the lubricated asbestos packing.



● A typical section of convoluted Flexible METAL Tubing showing the protective braided metal covering.

Flexible METAL HOSE AND TUBING INSTITUTE

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★ F-A

# 11% More Cutting Power

● *Speed*matic's straight-line gear drive delivers 98% of the motor power to the blade. You actually get 11% *more cutting power* through this higher efficiency of *helical* gears. Power-to-Spare that assures faster, cleaner sawing . . . avoids overloading and stalling. *Speed*matic is built to "take it and like it."

● See for yourself how *Speed*matic performs. Besides *power*, you will discover perfect scientific *balance* and a new *ease of handling*. Your local Porter-Cable man will gladly demonstrate—without obligation.

## 101 Sanding Uses with the New TAKE-ABOUT

● Popular on maintenance jobs for roughing down, leveling joints, fitting doors and sash, furniture repair—touching up—edging and spot-cleaning of plywood—removing paint and varnish. Also a cost-cutting production tool in hundreds of applications . . . because Take-About is high-powered, high-speed, dustless, 100% ball-bearing.

★ **WRITE TODAY for *FULL* information on the Porter-Cable machines that meet your purpose. Porter-Cable representatives are available for your service in all principal cities.**

**PORTER-CABLE** MACHINE COMPANY
2150-12 No. Salina St.
Syracuse, New York


presented with general information, diagrams, illustrations, capacity listings in Bulletin 130. Also contains data on runway current conductors and collectors, regular-type and close-clearance-type electric hoists, and standard track. Shepard Niles Crane & Hoist Corp.

**54** **SKIN PROTECTION** — Skin-Gard, a cream which protects hands against chemicals, solvents, dirt to avoid infection, cracks, and abrasion, is the product covered in a 4-page folder that also discusses the classifications, cause, and prevention of industrial dermatitis. Magnus Chemical Co., Inc.

**55** **SMALL DE-ION CIRCUIT BREAKERS**—Non-technical language is used to explain such features as coordinated inverse time tripping, visible trip indicator, non-tamperable calibration. The breakers described are for load-center, panelboard, switchboard, or enclosure mounting. Dimensions relating to mounting and space clearances, and dimension sketches are included. Price List and Dimension Section 29-060. 12 pages. Westinghouse Electric Mfg. Co.

**56** **STEAM, AIR, AND WATER EQUIPMENT**—Composite catalog of 5 sections contains operating data, dimensions, sample installations, recommendations for proper selection of such equipment as rotary-pressure joints, pressure-equalizing boiler-feed systems, electrically operated return traps, boiler-water controls, air and steam separators, oil absorbers and aftercoolers. The Johnson Corp.

**57** **STEAM TRAPS**—"How to Choose a Steam Trap" is full of valuable information concerning the proper applications for a wide range of steam traps —for air and gas separators, for autoclaves, for drips, etc.; tells how to choose and order traps, how to install and repair them. It is illustrated throughout and includes specifications. The V. D. Anderson Co.

**58** **STEEL GRATINGS AND STAIR TREADS**—Catalog 1773 tells all about electro-forged steel grating and stair treads. One section describing method of manufacture portrays a micrographic analysis of the forged structure. Uses are illustrated, table of safe loads and size variations is included. Blaw-Knox Co.

**59** **STEEL STAIR CONSTRUCTION, SAFETY TREADS, ORNAMENTAL METAL WORK** — Handbook of standard practice data contains drafting-room standards for steel stairs recommended by the National Association of Ornamental Metal Manufacturers. Includes a safe-load table and 13 pages of stair construction diagrams. Wooster Products Inc.

**60** **SWEEPER** — Gasoline-powered sweeper cleans and polishes floors and picks up dust in corners says Folder MA 1440 which tells about the sweeper's performance. Rite-Way Industrial Sweeper Co.

**61** **TEMPERATURE CONTROL** — 8 ways for using the Reactrol system —on electric air heaters, electrically heated boilers, chemical-reaction chambers, electric ovens, continuous-strip annealing furnaces, heat-treating furnaces,

# Rustless Chooses Towmotors

## FOR FASTER, LOWER COST HANDLING

Test installation brings repeat orders for 4 more machines in 10 months

DELIVERING COILS TO PICKLING TANK WITH RAM

At the great modern plant of Rustless Iron & Steel Corporation — where every production detail is geared for top speed and efficiency — you'll find Towmotor lift trucks handling the loads. And it's really amazing to see these nimble "one-man-gangs" get around — even in close quarters.

One minute, they're busy hustling coils, plates, or billets from process to process. Next minute, they're somewhere else — stacking materials for storage, loading box cars or highway trucks, doing scores of other back-breaking jobs — *all in a fraction of the time required by other methods.*

And remember, Rustless' happy experience is only one among many. With leading *professional* handlers, it's Towmotors every time because tests prove that Towmotors move more tons per day at less cost per ton. Capacities up to 10,000 lbs. Mail the coupon today for complete information.

MILLWRIGHT WORK

HANDLING ROD ON SKIDS

HANDLING BILLETS ON FORKS

## Let TOWMOTOR (CLEVELAND) take the load off your hands

TOWMOTOR COMPANY
1270E. 152nd St., Cleveland, Ohio

Please rush complete facts on Towmotor lift trucks.

WRITE FOR FREE CIRCULAR

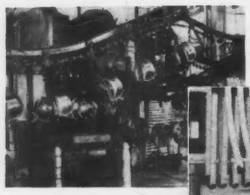
NAME _____

TITLE _____

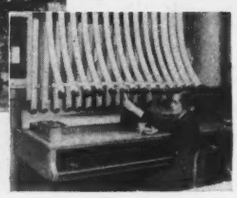
*(Please attach coupon to your Business Letterhead)*

Now
# DRAFT
Your Own
RESERVES
of Manpower and
Plant Space...

**LAMSON Co-ordinated Control** will help you to keep down excessive plant expansion



*Overhead Conveyors put ceilings to work.*



*Lamson Pneumatic Tubes provide closer production control.*

You want more production for Defense contracts . . . more room to grow in. But you dread the danger that lies in excessive plant expansion. If only there were some other way. Some way to get more production—now, quickly—without building.

But there is a way. LAMSON Co-ordinated Control will help you do it. This combination of modern conveyors and speedy dispatch tubes may be the very answer to your problem—at least until you're certain that you must have more plant space. For this system not only eases the burden on your workmen, not only makes their efforts more productive . . . not only gives you more effective control over every process . . . BUT IT ACTUALLY CLEARS UP YOUR AISLES . . . gives you MORE FLOOR SPACE for MORE MACHINES.

**61 Years of Specialized Experience**

Let Lamson engineers, with a background of 61 years of specialized conveyor experience, help you with your problem. There's no cost or obligation for a preliminary analysis. Just consult your classified telephone directory for the name of the resident engineer, or write Lamson Corporation, Syracuse, N. Y., for complete details.

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SYRACUSE, N. Y.


electric steam superheaters, laboratory-type furnaces—are outlined in Bulletin GEA-3436. General Electric Co.

**62** **"THE COMPRESSOR OF 1,000 USES"**—Is the title of a profusely illustrated pamphlet that tells all about the Unitair compressors—the built-in motor type, with belt drive from motor, with direct connection to motor. Construction features are pointed out. The power-unit drive and single-stage Unitairs are also described. Specifications are given. Sullivan Machinery Co.

**63** **TIMEPIECE**—Uses, construction, features of the Multi-Chron—combination watch, timer, telemeter, tachometer—are outlined in an illustrated folder. Jules Racine & Co.

**64** **TIME SAVER CHARTS**—Figure temperature rises for various operating conditions and include a table on air temperature rise conversion constants. The charts are produced in 4-page form on heavy stock protected from soiling by a celluloid-like finish. Fedders Mfg. Co., Inc.

**65** **TIME SWITCHES** — GEA-2963B discusses type TSA-14 time switches for control of a.c. circuits and for automatic control of exhaust fans, pumps, blowers, and so forth. Construction is described, ordering information is given, prices are listed. General Electric Co.

**66** **TRANSMISSION BELTING**—Condenser information on a line of transmission belting is what a 4-page catalog section contains. Highflex, Highflex, Jr., Drivesall are among the belts described. Belt dressing and Plastikon stick dressing, net weights of belts per inch of width per 100 ft., table on stock sizes are included. The B. F. Goodrich Co.

**67** **UNIT COOLERS AND VALVES**—Catalog AC 300 lists specifications, dimension and performance data, and prices on a line of coolers for comfort cooling, mechanical refrigeration, and for use with cold water. Also contains information on a thermostatic expansion valve, the Clip-On Superheat Thermometer, and the high-capacity thermostatic expansion valve. Illustrated. Fedders Mfg. Co., Inc.

**68** **UNIT HEATERS** — Designed for use in buildings with high ceilings that make heating a problem are described in Catalog 2540. Photographs illustrate the units and installations. Capacity and dimension tables are included. Young Radiator Co.

**69** **VALVES, PIPE FITTINGS, FIRE HYDRANTS** — Catalog 63, 239 pages of data on bronze and iron-body valves for low, standard, and higher pressures; standard bronze and malleable-iron screwed fittings; standard cast-iron flanged fittings and flangers; fire hydrants; various valve specialties. Illustrations are used throughout. Recommendations for the selection of valves and fittings; suggestions for operation, care, and maintenance of valves are included. To facilitate use of catalog there are five indexes and tabulations of references on all pages of listings and dimensions. The Kennedy Valve Mfg. Co.


# BATESGRATES
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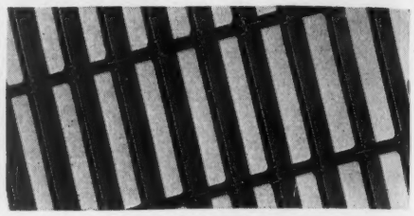

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Batesgrates are self-cleaning because of peaked, non-skid cross bar. They have no grooves or rough burned metal to catch grease or dirt. Safe traction. Batesgrates are strictly one piece—no cuts, slots, or punching. Made from Hexagon Shaped Hot Rolled Steel Bars with smoother, larger, much stronger welds. Send today for engineering Catalog No. 937.

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  **Maintenance Economies**
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  **used Throughout**
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*Let us create the "Tailor-Made" Pallet for your Particular Product*

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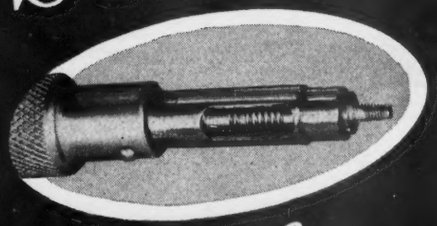
**SALES CORPORATION**
122 East 42nd St., New York City

# THE Taming of the Screw



by— Thor

*New*
## "PIX-UP" FINDER
**& ADJUSTO-TRAY**

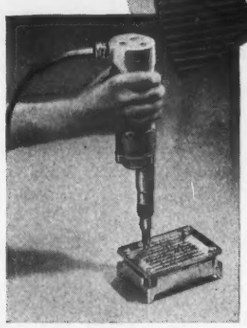
### New Device Picks Up Screw and Holds It for Driving

Thor has "tamed" the screw indeed! For the new Thor "Pix-Up" Finder and Adjusto-Tray, which picks up the screw *mechanically* and holds it for driving, now gives the operator *complete control* over the screw preparatory to driving. This new device eliminates entirely the operations on which human "butterfingers" waste costly seconds — picking up, starting, and guiding the screw. As a result, assembly moves along 3 to 9 times faster! For full details, send the coupon below!

Thor
PORTABLE POWER TOOLS

**1. SORTS . . .**

Screws are tossed on slotted Adjusto-Tray. They drop into the slots with heads up, ready for instant pick up.



**2. PICKS UP . . .**

Screw driver is lowered to Adjusto-Tray, which depresses to thrust screw head into "Pix-Up" Finder. The grip is secure, the screw perfectly aligned.

**3. DRIVES!**

The screw driver is brought to the work and the screw driven. One, two, three — the job's done! Assembly goes 3 to 9 times faster!

Thor

**Thor Portable Pneumatic Screw Drivers** of the 215 type drive up to No. 8 screws. Weigh only 1½ to 2¼ lbs. Available in three throttle types.

**Thor Portable Electric Screw Drivers** of the U16A type drive all screws from No. 4 to No. 12. Shorter, lighter, they are truly one hand tools.

### All Thor Screw Drivers can be Equipped with the New "Pix-Up" Finder

Every Universal Electric, Pneumatic, and High Frequency screw driver that Thor makes can be equipped with the new "Pix-Up" Finder. It can be furnished for use with any type of screw head . . . on any size of screw. It is particularly adaptable, of course, for driving No. 8 screws or smaller.

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600 WEST JACKSON BLVD., CHICAGO, ILL.

Birmingham, Boston, Buffalo, Cleveland, Detroit, St. Louis, Salt Lake City, San Francisco, Toronto, London, Los Angeles, Milwaukee, New York, Philadelphia, Pittsburgh

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☐ Please send full information on the new Thor "PIX-UP" FINDER and ADJUSTO-TRAY.
☐ Please have Thor salesman demonstrate the new Thor "PIX-UP" FINDER and ADJUSTO-TRAY. No obligation.

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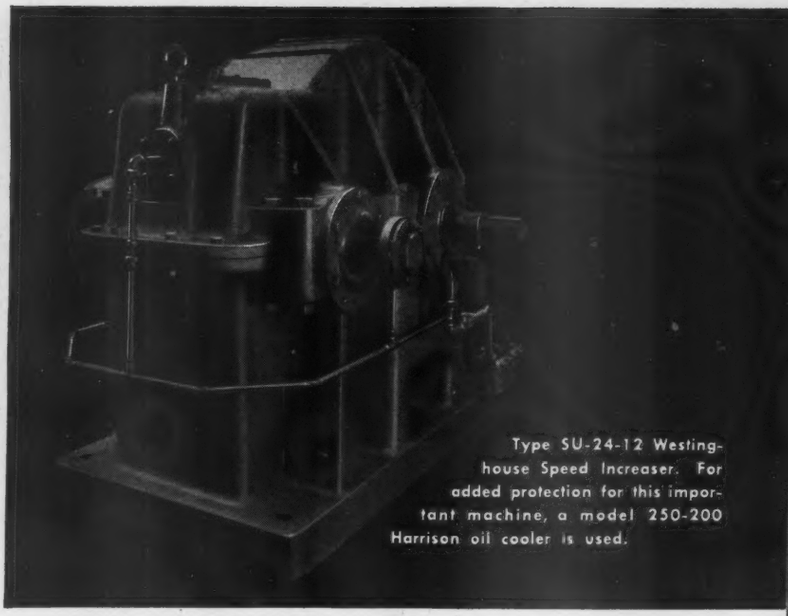
Company_____
Address_____
City_____ State_____



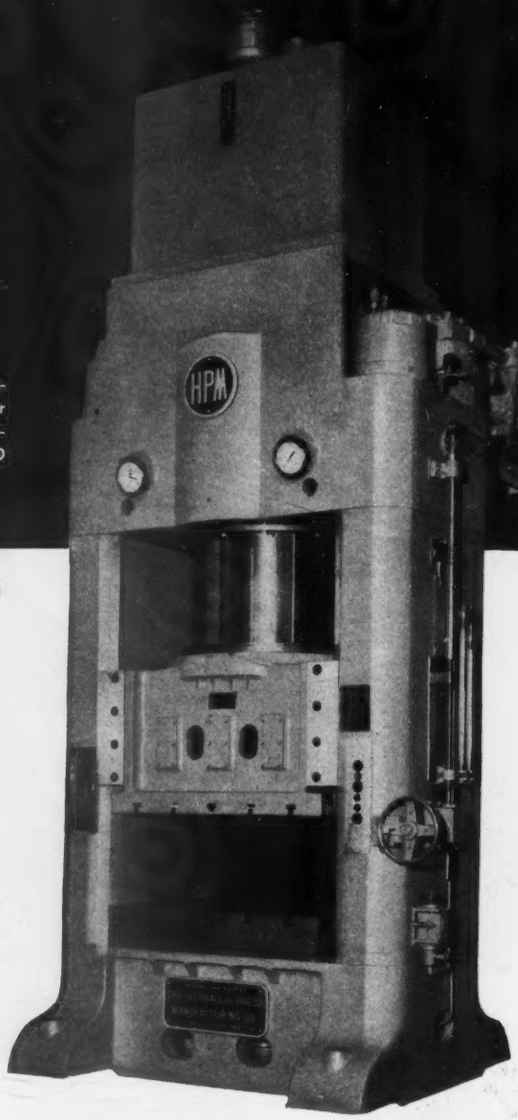
Type SU-24-12 Westinghouse Speed Increaser. For added protection for this important machine, a model 250-200 Harrison oil cooler is used.

# REGULATE OIL TEMPERATURES WITH *HARRISON* OIL COOLERS

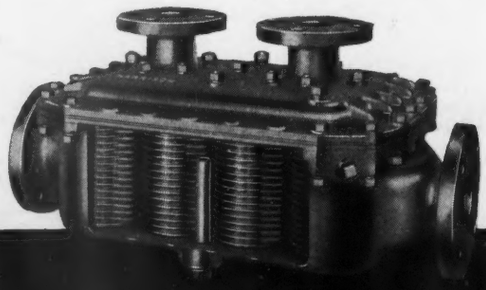
**As industrial production goes into high gear, builders and operators of fine machine equipment turn to Harrison for increased operating efficiency—better protection against wear.**

**Harrison oil coolers maintain proper operating temperatures for hydraulic presses, Diesel and gas engines, speed increasers and a wide variety of other machines. By regulating oil temperatures—keeping them within the most efficient ranges—they help lengthen machine life and assure lower operating costs. The compact design and rugged construction of all Harrison units "fit in" with the most modern machine designs and operating requirements.**

**Backed by extensive research and testing facilities, Harrison engineers are prepared to offer advice and consultation on problems involving machine temperature regulation. Write today for specific information on the complete range of sizes and types of oil cooler units manufactured by Harrison.**




**1000-ton "Fastraverse" Platen Press manufactured by the Hydraulic Press Manufacturing Co., of Mount Gilead, Ohio. A Harrison oil cooler—model HE-70—increases its operating efficiency.**



*HARRISON*

RADIATOR DIVISION, GENERAL MOTORS CORPORATION, LOCKPORT, NEW YORK

# Industrial Management Gets a New Industrial Tool

Better solutions to common factory problems arrive in your plant when a new Mimeograph duplicator arrives. If your business is affected by model changes, style changes, or an extensive line of products, put this great business machine to work on the production order problem. It can turn out those production orders—giving complete information and instructions to every factory department, covering every manufacturing operation, routing work through the plant—in quantity, with speed and substantial savings.

If you want a more effective inspection record—for greater uniformity of product—use the Mimeograph duplicator for inspection reports covering raw materials, work in process, and finished products. You'll not only cut the cost of factory forms, but you can also "streamline" certain forms to save money in a number of departments.

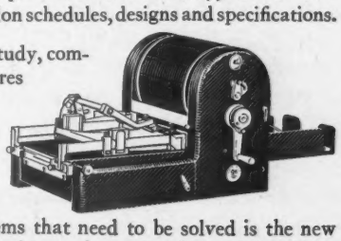
For a number of companies, the many economies and efficiencies introduced by our trained experts have resulted in a substantial contribution to lowered costs. We are ready to help you get similar savings in your plant. For complete details, call the Mimeograph representative in your locality, or write A. B. Dick Company, Chicago.

**FREE!** Now ready—new portfolio of sound ideas for greater plant efficiency, resulting from studies of many hundreds of organizations throughout the country. Includes samples of factory forms prepared by L. P. Alford, editor of "Cost and Production Handbook." Clip and mail the coupon today for your free copy of *Manufacturing Profits*.

## Typical Plant Problems—solved by the Mimeograph duplicator

***Production***—raw material requisitions and inventory, bill of materials, production orders, production schedules, designs and specifications.

***Control***—time records, time study, compensation, records of temperatures and chemical analyses, daily production record of machines (to prevent underload or overload).



Ready to work on plant problems that need to be solved is the new Mimeograph 92 duplicator in the picture above. Another member of the complete streamlined family—the Mimeograph 91 duplicator shown here.

# Mimeograph

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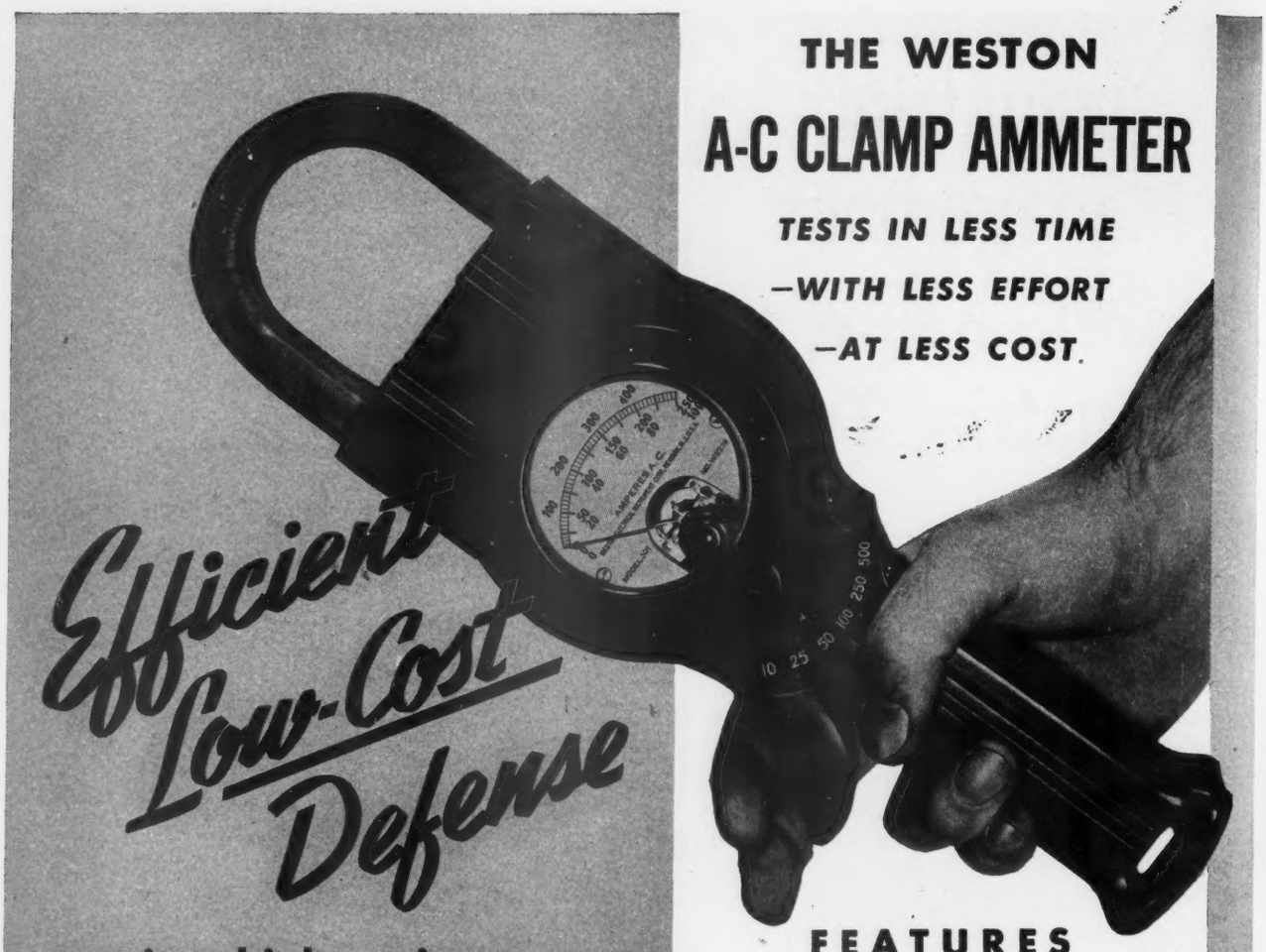

# THE WESTON
# A-C CLAMP AMMETER

***TESTS IN LESS TIME***
***—WITH LESS EFFORT***
***—AT LESS COST.***

## *Efficient Low-Cost Defense*

## against high maintenance

With *no* connections to make, and *no* interruptions of circuits . . . maintenance can now do a better job, and do it more quickly and conveniently. *The jaws of this* WESTON *AC Clamp-Ammeter need only be placed around the conductor, bus bar or switch blade, for current readings.* Thus only a *fraction* of the time is now required to test and insure the efficient operation of all electrical equipment.

And for all other instrument needs, whether for switchboard or panel mounting, production requirements, or laboratory research...WESTON can supply instruments which likewise combine *unquestioned dependability* and *time-saving facility* to the highest degree. » » » For complete information on the WESTON AC Clamp-Ammeter and other WESTON instruments, 'phone the WESTON representative near you, or write to Weston Electrical Instrument Corp., 591 Frelinghuysen Avenue, Newark, New Jersey.

## FEATURES
### which assure
***greater safety—efficiency—economy***

★ **ONE HAND OPERATION** — clamping jaws readily opened and closed by convenient trigger. Range changing switch thumb operated.

★ **6 CURRENT RANGES** — 10/25/50/100/250/500 amperes. Higher ranges also available.

★ **HIGH INSULATION** — jaws heavily insulated to protect operator and prevent shorts — entire case of sturdy Bakelite for maximum safety.

★ **PERFECT BALANCE** — for quick, easy handling.

★ **ENDURING DEPENDABILITY** assured by WESTON instrument and WESTON manufacture.

Laboratory Standards . . . Precision DC and AC Portables . . . Instrument Transformers . . . Sensitive Relays . . . DC, AC, and Thermo Switchboard and Panel Instruments.

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Specialized Test Equipment . . . Light Measurement and Control Devices . . . Exposure Meters . . . Aircraft Instruments . . . Electric Tachometers . . . Dial Thermometers.

***FOR OVER 52 YEARS LEADERS IN ELECTRICAL MEASURING INSTRUMENTS***

# New TIME and SPACE Savers

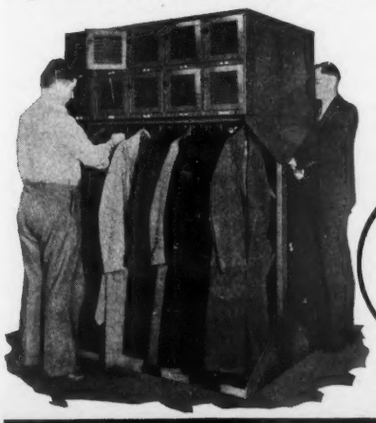
● New practical aids for factory executives faced with production shedules that put a premium on speed, floor space, or both. The newest units in Lyon's complete line of shop, toolroom and storage equipment, the portable Work Bench and Assembler's Bench Bin were developed to help save time and space in these days of emergency orders, limited floor space, and expanding personnel.

LYON *Portable* BENCHES

**LYON PORTABLE BENCHES** are equipped with two stationary, semi-steel casters with roller bearing axles, and easily gripped wheelbarrow type handles. Riveted and welded construction insures positive rigidity for precision work.

LYON *Assembler's* BENCH BIN

**LYON ASSEMBLER'S BENCH BIN**—Answers assembler's problem of handling small parts with greatest speed and accuracy. Has 12 self-feeding hopper compartments (see illustration). Placed on the assembler's bench or table, the Lyon Assembler's Bench Bin brings a supply of up to 12 different small parts on a bench space of only 9" x 16"... speeding up assembling by eliminating overreaching or getting up to locate parts... eliminating waste and confusion by assembling from loose piles of parts or odd-sized cartons.



LYON SHOP ROBE

**LYON SHOP ROBE**—Safe and compact storage for employee's clothing and personal belongings. Easily moved. Accommodates 20 men in 12½ sq. ft. of floor space.

## AVAILABLE THROUGH SHOP EQUIPMENT DISTRIBUTORS

Make a memorandum now to ask your shop equipment distributor salesman for full details and prices on Lyon Portable Benches, Lyon Assembler's Bench Bins and Lyon Shop Robes the next time he calls. His organization is equipped to give you prompt delivery on these new time and space savers . . . as well as on many other shop, toolroom and storage units that have proved their worth in speeding up production, reducing stock inventories, and holding down breakage and losses of stock, tools, etc

**LYON METAL PRODUCTS, Incorporated**
**1212 River Street, Aurora, Illinois**

Send complete information on items checked:

- ☐ Portable Benches
- ☐ Assembler's Bench Bin
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**LYON** *SHOP EQUIPMENT Service*

LYON METAL PRODUCTS, INCORPORATED. *General Offices:* Aurora, Ill.
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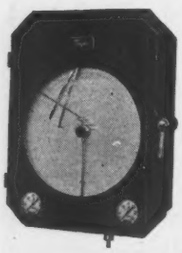
## You Can Get **Not 1 but 5 Forms of Control** in the **NEW TAYLOR FULSCOPE CONTROLLER**

THE NEW Taylor Fulscope Controller is unique. It can *grow* in your plant. It can grow as your processing needs grow. At first your processing needs may be simple, so you install the simplest form of the new Fulscope. As time goes on, perhaps your production expands, and your processing operations become more demanding. You need a different controller. What to do? Buy another instrument? You don't need to! Another unit assembly may be added to or substituted in your basic Fulscope Controller. That converts it into the controller your progressing needs require. You see, merely by adding or substituting such unit assemblies in the drilled and tapped Fulscope cases, it's possible to expand the Fulscope Controller to give all types of process control—from simple *fixed high sensitivity*, through *adjustable sensitivity, adjustable sensitivity with automatic reset*, to *adjustable sensitivity with Pre-Act*, (Taylor's amazing new control effect based on rate of control-point deviation) and *adjustable sensitivity with automatic reset and Pre-Act*, the ultimate in process control. You may never need such advanced control, but Taylor has it if you want it. The new Taylor Fulscope Controller is industry's 5-in-1 controller for *all* kinds of process control.

There's a national need today for this astonishingly versatile, adaptable Fulscope Controller. Industry's biggest job is helping America prepare fast. You must be prepared to produce top quality at top speed. With this new Taylor Fulscope Controller in your plant, you *are* prepared. No other process controller is so completely new—none has been so completely redesigned (not just tinkered with)—no other is so easily adaptable to growing, changing processing needs. Your own preparedness program can well begin with the new Taylor Fulscope Controller.

Ask the Taylor man what the 5-in-1 features of the new Fulscope mean specifically to *you*. Find out about the recording and indicating types—for temperature, pressure, flow, and liquid level. Learn about the new Taylor Recorder, twin of the Taylor Fulscope Controller. *Now*—from Taylor Instrument Companies, Rochester, N. Y. Plant also in Toronto, Canada.



**Not 1, but all these 5 Forms of Control Available in the NEW TAYLOR FULSCOPE CONTROLLER**

Fixed High Sensitivity—Adjustable Sensitivity—Adjustable Sensitivity with Automatic Reset (in same case)—Adjustable Sensitivity with Taylor's unique Pre-Act effect Adjustable Sensitivity with Automatic Reset and Pre-Act

*All Fulscope Controller cases are drilled and tapped to permit adding or substituting different forms of control—easily, right in the field!*

**BE PREPARED with TAYLOR INSTRUMENTS**

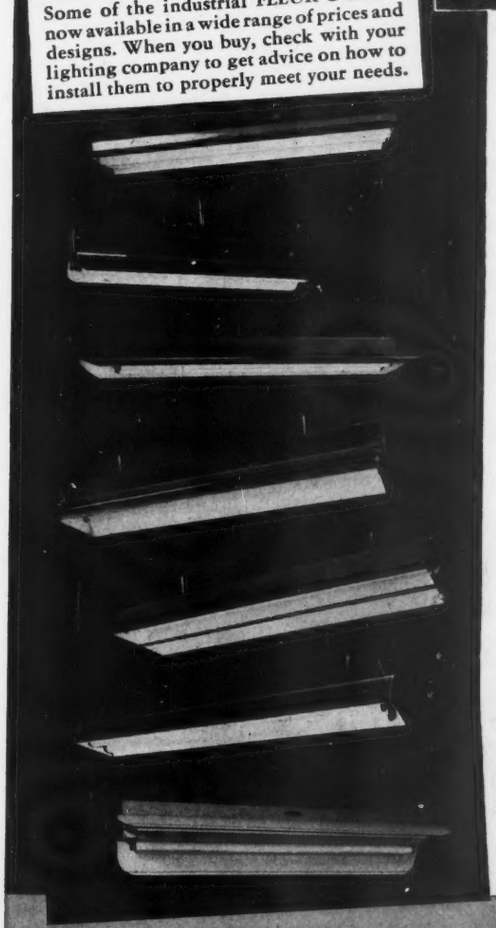
**Taylor**

**Indicating Recording Controlling**

**TEMPERATURE, PRESSURE, FLOW and LEVEL INSTRUMENTS**

# "There's no difference between day and night shifts"

Some of the industrial FLEUR-O-LIERS now available in a wide range of prices and designs. When you buy, check with your lighting company to get advice on how to install them to properly meet your needs.



## when you use fluorescent in Certified* FLEUR-O-LIERS

● The old-fashioned night shift is a thing of the past! Today—in factories lighted with amazing new fluorescent indoor daylight—men working at night can *see better* . . . consequently work faster, more accurately, and with less fatigue under this higher level lighting.

It pays to get fluorescent daylighting at its very best . . . in efficient new Certified★ FLEUR-O-LIERS. They are made by over 35 fixture manufacturers . . . *certified* by Electrical Testing Laboratories for good light—safe, reliable service, under specifications set up by MAZDA lamp manufacturers.

Look also for E.T.L. certification of auxiliary equipment (ballasts and starters) to be sure of satisfactory performance. It pays to take this simple but effective precaution.

Check with your lamp distributor or electrical contractor . . . or write for new free FLEUR-O-LIER Fact Book with complete information and list of manufacturers.

FLEUR-O-LIER
"SPECIFICATIONS FOR LUMINAIRES, FITTINGS AND AUXILIARIES FOR FLUORESCENT LAMPS"
ELECTRICAL TESTING LABORATORIES
ETL
THIS CERTIFICATION IS CONTINGENT UPON EMPLOYMENT OF CERTIFIED AUXILIARIES OF OVER 85% POWER FACTOR

## "LOOK FOR THIS LABEL"

**It is your protection.** *Electrical Testing Laboratories* certify *that FLEUR-O-LIERS have met with 5 specifications for Lighting Effectiveness—6 for Electrical Safety—18 for Mechanical Soundness—14 for Electrical Excellence . . . as set up by MAZDA Lamp manufacturers. All Certified★ FLEUR-O-LIERS must be equipped with auxiliaries (ballasts and starters) certified by E. T. L.*

# FLEUR-O-LIER *Manufacturers*

**Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer whose product complies with FLEUR-O-LIER standards**

***TEAR OUT AND MAIL***

**Fleur-O-Lier Manufacturers • 2116 Keith Bldg., Cleveland, Ohio**

Please send me helpful information about Certified FLEUR-O-LIERS, packages of indoor daylight for stores ☐ offices ☐ factories ☐

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WE USE SKF BEARINGS

WESTINGHOUSE ELEC. & MFG. CO.

# FIGHT FRICTION . . . with SKF Bearings

In these days when Industry's seeking to do *more* in *less* time, a member of the Fifth Column is making expensive machines groan constantly for oil . . . holds the threat of shutdowns for bearing repairs over every production man's head. His first name is Friction . . . and he lurks wherever machines can't fight back.

Therefore, use SKF Bearings protected by SKF Pillow Blocks. Easy to assemble, inspect and lubricate, these friction-fighters occupy very little space. They keep lubricant IN . . . dust, dirt and moisture OUT . . . are equipped with the exclusive SKF Triple Seal . . . can replace plain bearings without the necessity of machining shafts. By doing these things well, they not only keep Friction away, but pay for themselves within a short time. Your SKF distributor can tell you more about them.

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SKF INDUSTRIES, INC., PHILADELPHIA, PENNA.

SKF
Puts the Right Bearing in the Right Place

# *with* POLISHED SMOOTHNESS!

## That's how this NEW DELTA MACHINE Cuts Copper, Brass, Aluminum

This new Delta Cut-off machine is designed especially for cutting copper, brass, aluminum and other non-ferrous metals with polished smoothness. It is equipped with a special high-speed steel blade and oiling device which feeds cutting oil to the blade. It leaves the cut perfectly smooth, thus eliminating additional finishing and polishing operations. Here is a powerful, accurate machine made available at a fraction of the prices customarily charged for machines of this type. It can be used anywhere, in large shops or small, where non-ferrous metals have to be cut to accurate length on a production basis. At these remarkably low price levels you can actually get two cut-off machines for the price of one—machines that can be used for scores of jobs, and quickly pay for themselves in time and money saved!

**Cuts These Materials With Polished Smoothness**

**Solid Sections:** Soft Brass up to 1½" diameter; Half-Hard Brass, up to 1¼" diameter; Aluminum, up to 1½" diameter; Aluminum Extruded Sections, up to equivalent of 2 sq. in.; Copper, up to 1½" diameter, or equivalent of 2 sq. in.; Magnesium (Dow Metal), up to 1¼" diameter; Micarta and Similar Rods, up to 1½" diameter.

**Tubular Sections:** Soft Brass, Hard Brass, Aluminum, Copper, Dow Metal, Micarta and Similar, Tubing, all up to 2" diameter.

**Has Many Special Features**

This improved Cut-Off Machine is ruggedly constructed with heavy castings throughout—wide spaced Timken roller pivot bearings and double arbor sealed-for-life bearings requiring no lubrication — powerful Texrope V-Belt drive — adjustable fence—accurately machined table. It is perfectly balanced, making for easy operation—cuts material at any angle and embodies unusual safety features such as husky chip guard, belt and wheel guards.

*No. 1631 Non-ferrous Cut-Off Machine, consisting of No. 1600 cut-off machine No. 1626 Blade and No. 1632 oiling device and No. 1399 legs. With blade guard, belt guard and chip guard.*

**Send for Special Cut-Off Machine Bulletin**

giving full details and prices on this Delta Cut-Off Machine and all accessories.

**DELTA MFG. CO.** (INDUSTRIAL DIVISION)

675 East Vienna Avenue, MILWAUKEE, WIS.

Delta Manufacturing Company
675 E. Vienna Avenue, Milwaukee, Wis.

Please send me special bulletin on the new Delta Cut-Off Machine for non-ferrous metals. Also send latest Delta Catalog of Industrial Power Tools.

Name .....
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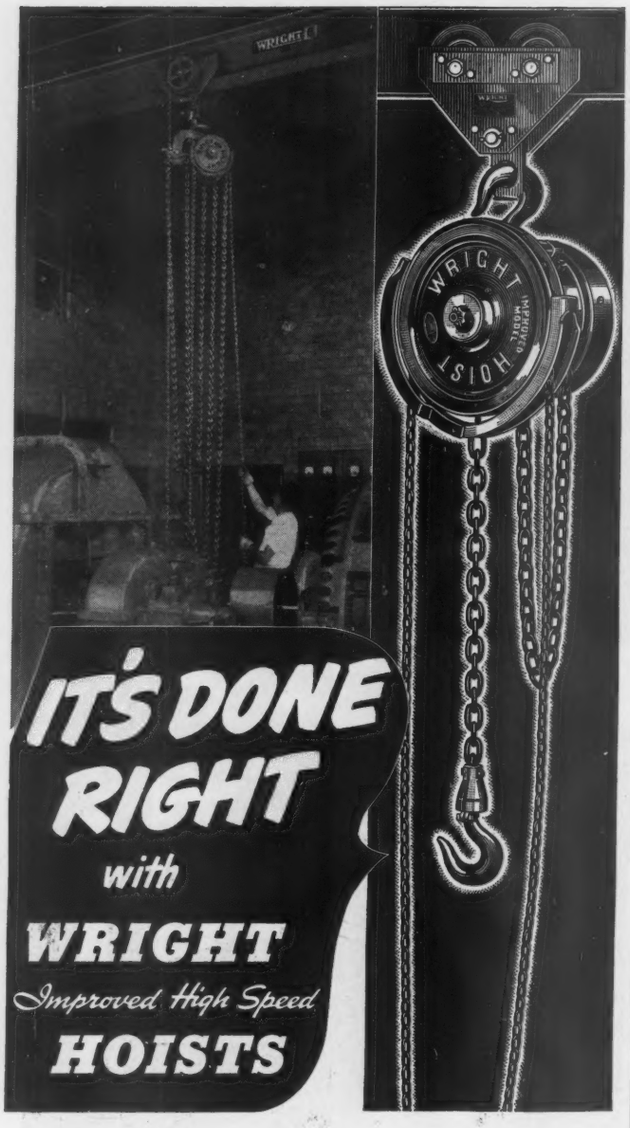



# IT'S DONE RIGHT with WRIGHT *Improved High Speed* HOISTS

Every **Wright Improved High Speed Hoist,** in any capacity from ¼ to 50 tons, has 21 definite points of superiority. Precision load wheel bearings assure fast, smooth, positive action. Full zinc coating resists corrosion. The Wright safety guard always keeps the load chain in the pocket, regardless of operating position.

**Wright Trolleys** serve as reliably and economically as Wright Hoists.

The Wright Catalog includes much valuable hoisting information. Write for your free copy.

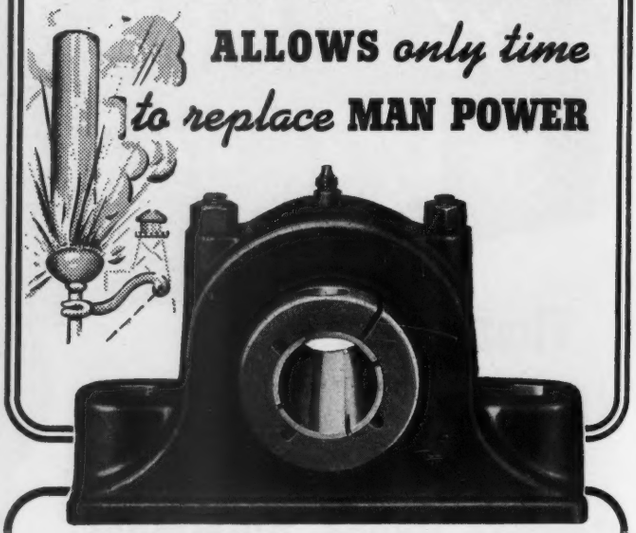
**BUY ACCO QUALITY** *in Wright Hoists, Cranes and Trolleys; Tru-Lay Preformed Wire Rope; Reading-Pratt & Cady Valves; Campbell Abrasive Cutting Machines; American Chains; Page Welding Electrodes and Page Wire Fence.*

**WRIGHT MANUFACTURING DIVISION • YORK, PA.**

*In Business for Your Safety*

**AMERICAN CHAIN & CABLE COMPANY, Inc.**

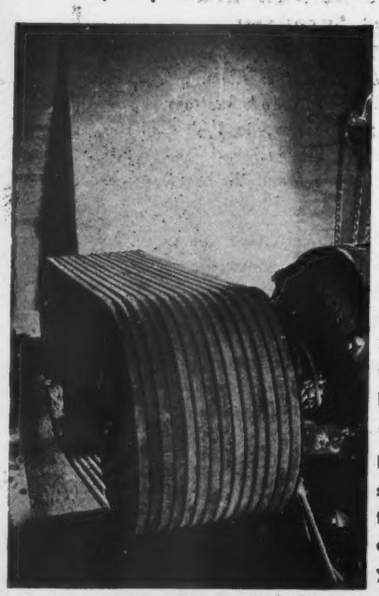
# *The* BLOWING WHISTLE ALLOWS *only time to replace* MAN POWER



***As working hours step up from 1 to 2 . . . 2 to 3 shifts — the standardization of your drives with***

## MEDART TIMKEN PILLOW BLOCKS

becomes more and more important. Medart Timken Pillow Blocks require no attention in service except infrequent lubrication — *running or idle.* Installation or removal is a matter of minutes in most cases. They will not leak lubricant because they are sealed and dirt cannot enter the housing . . . the four types to cover the full range of applications are all assembled, adjusted and lubricated before shipment.



## NOW is the time . . .

To analyze the condition of your drives. Long maintenance or repair procedures during "around the the clock" production mean idle men and idle equipment...both far too valuable to lose in these times.

Write us — or ask your local Medart representative or distributor to make specific recommendations to fit your needs.

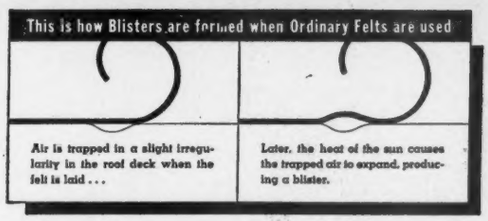
**THE MEDART COMPANY**
3512 DeKalb St. St. Louis, Mo.

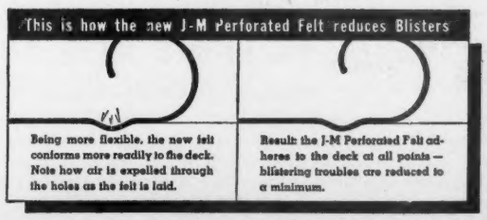
**MEDART**

# MILLIONS OF TINY HOLES
## ...Make a BETTER ROOF!

## J-M's 15-LB. *Perforated* ASBESTOS FELT

**Today's newest roofing development... increases the efficiency of smooth-surfaced roofs . . . minimizes "Blistering" hazards!**


This is how Blisters are formed when Ordinary Felts are used
Air is trapped in a slight irregularity in the roof deck when the felt is laid . . .
Later, the heat of the sun causes the trapped air to expand, producing a blister.


This is how the new J-M Perforated Felt reduces Blisters
Being more flexible, the new felt conforms more readily to the deck. Note how air is expelled through the holes as the felt is laid.
Result: the J-M Perforated Felt adheres to the deck at all points — blistering troubles are reduced to a minimum.

LONG FAMOUS for fire-, weather-, wear-resistant built-up roofs, J-M now offers a new-type felt! It's the *Perforated Asbestos Felt* . . . and it increases roof service by greatly reducing blistering hazard—defying roofing's No. 1 enemy—the sun.

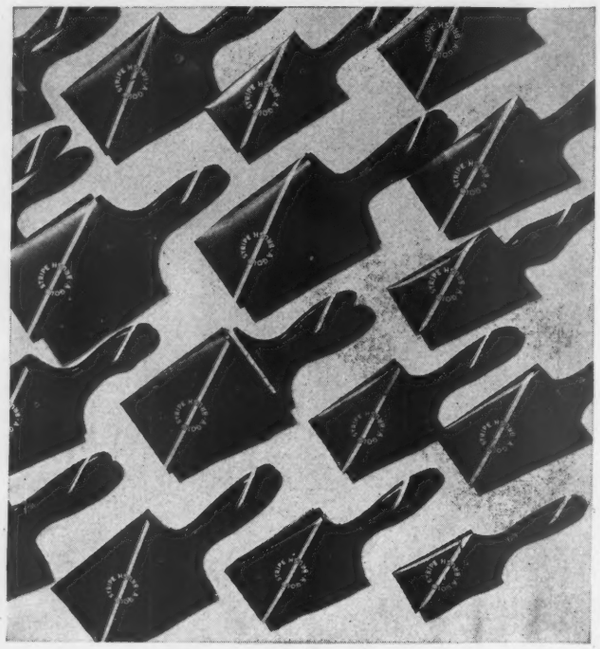
As every roofer knows, when laying conventional felts, "air pockets" are often formed. As the sun's heat causes the trapped air to expand, blisters result. The J-M Perforated Asbestos Felt is provided with millions of tiny perforations—"check valves" that open upward to allow trapped air to escape during application, but are completely sealed by the waterproofing asphalt when the roof is laid. Result: the Perforated Felt adheres closely to the roof deck . . . blistering troubles are minimized.

Now with this new material supplementing the durability and fire-safety of asbestos, you get more value per dollar than ever in a J-M Smooth-Surfaced Built-Up Roof. For details, write Johns-Manville, 22 E. 40th St., New York, N. Y.

**JM JOHNS-MANVILLE**
**Smooth-Surfaced ASBESTOS BUILT-UP ROOFS**

THE ROOF WITH THE SAFETY FACTOR

# JUST A FEW HOURS AWAY



## Brushes

● There's a Pittsburgh Plate Glass Company warehouse near you carrying a complete stock of Gold Stripe Brushes for all types of paint jobs and a full line of Industrial Brushes, such as Floor Sweeps, Mill Dusters, Wire Scratch and Casting Brushes.

You can save time and money by concentrating your purchases in this one convenient source of supply.

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*Send for catalog and for full information regarding the convenient contract service plan.*

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## Exact Weight Scales

American Industries . . . especially the war group now attain near analytical precision in their high speed production. Real scales are the telling factor. This is the reason for ever increasing sales of the EXACT WEIGHT Shadowgraph for such operations as parts selection and severe tolerance operations. The fact that Shadowgraph features analytical precision without parallax readings in high speed production ... features heretofore impossible with ordinary scales tells the story of this popular weighing unit.

*Write for complete details for your plant!*

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THERE IS NO SUBSTITUTE FOR EXACT WEIGHT
INDUSTRIAL
PRECISION SCALES

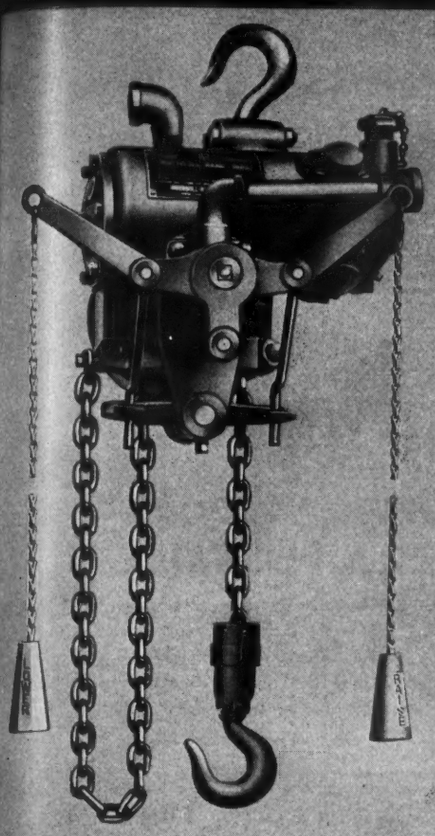
## NEW •• The LEWIS SKID BOX with STACKING RUNNERS

**Here is a new design for an industrial container. Note particularly the skid and stacking runner construction. There is ample clearance for the lifting fork of a power lift truck for an easy pick up. Then as one box is placed on top of another the specially designed stacking runner nestles down into the top of the box below to give unusual stability to the whole stack — a safety feature that prevents accidental dislodging of boxes. The box is of woven elm slats and wire — a proven construction that offers comparatively light weight with strength and durability. *Send for information!***

LEWIS
INDUSTRIAL CONTAINERS

**G.B.LEWIS COMPANY**
**Dept. N12**
**Watertown, Wis.**

# LIFT WITH AIR POWER
## and
# Spare Man Power



The AIR-BLOC — 3 Sizes — 300-500-700 lbs. capacity.

The AIR-BLOC serving a vertical turret lathe. Note the flexible, welded link-chain which cannot be broken by twisting.

## Use The New AIR-BLOC for Lighter Loads

### — Precision Lifting with Speed and Safety in

—Factories

—Industry Everywhere

—Machine Shops

—Assembly Lines

—Maintenance Shops

—Shipping and Receiving Departments

## FEATURES AND ADVANTAGES

1—Fitted with a flexible, welded link-chain which will not break when twisted.

2—Constructed so that the load cannot drop even if the air supply fails.

3—Easy to move—Weighs less than 75 pounds.

4—Automatic Safety Up-and-Down-Stop—Prevents damage to hoist from over-run of chain in either direction.

5—Dust-Proof oil chamber in which all moving parts are automatically lubricated.

6—Radial airplane type of air motor gives compact construction.

7—Graduating reversing valve gives instant and complete control of the hoist action.

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**TRU•LAY Push-Pull Controls** instantly transmit the slightest control impulse. They hold any position to which they are set.

These controls are easily installed—merely snaked around obstructions—and are easily adapted to the remote operation of valves, clutches, switches and other mechanisms. They require no maintenance attention and can't become noisy or "sloppy" in operation.

***Send the Coupon for this* FREE BOOKLET**

*"The Key to Remote Control" points out many advantages you can have in machine control. Mail the coupon today.*

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Slippery floors may be just as expensive in cafeterias as in washrooms or around machines. There is an easy and inexpensive way to make them safe in many places . . . paint with Fera-Flow. Fera-Flow is a high quality, long-wearing floor paint containing an extra ingredient that gives a sure-footing.

*Granular Fera-Flow surface grips even a wet sole.* *Conventional floor paint. Photographs unretouched.*

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**NON-SLIP FLOOR PAINT**

**AMERICAN ABRASIVE METALS COMPANY**
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Send for painted samples and folder telling where and how to get safety under foot with Fera-Flow.

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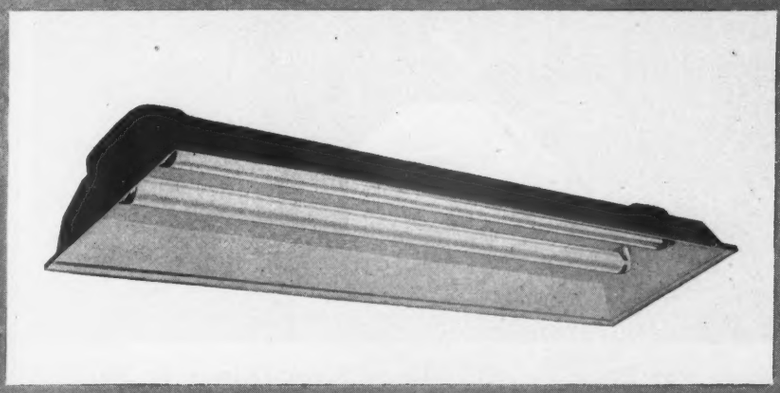


New RLM Fluorescent Luminaire for general factory lighting ... available with or without openings for ceiling illumination.

## 100-Watt Fluorescent Unit with Detachable Hood

Meeting the demand for higher industrial illumination levels, Westinghouse announces its new RLM Fluorescent Lighting Fixture for two 100-watt lamps.

Not only does this NEW Westinghouse unit meet the rigid specifications of the RLM Standards Institute, but also the maintenance-wise specifications of industry for two-piece separable construction.

With lamps removed, a simple quarter turn of two tension-locked thumb latches releases the reflector from the hood without disturbing line connections. The reflector may then be taken down for thorough cleaning. Time for both installation and maintenance inspection is reduced to a minimum since wiring and auxiliary equipment in the hood are readily accessible from all sides.

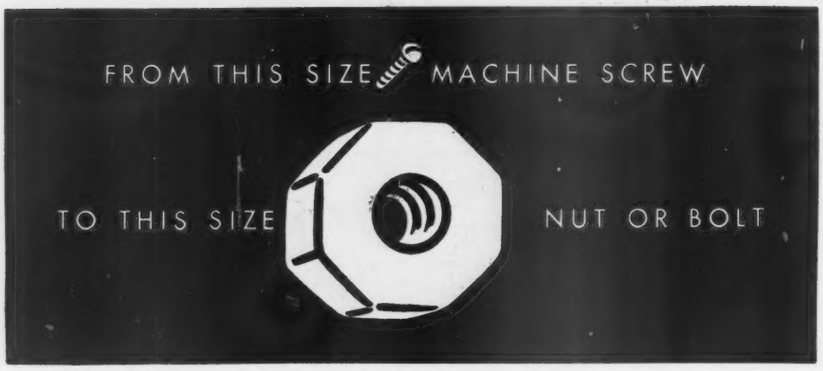
Westinghouse also makes available a complete line of Industrial Fluorescent Fixtures, including two-lamp, 100-watt open-end porcelain enameled reflectors.

117 Westinghouse Electric Supply Company Offices and Independent Westinghouse Lighting Distributors offer complete local stocks and services. For complete information, write for C. S. 61-152-H, Lighting Division, Westinghouse Electric & Manufacturing Company, Edgewater Park, Cleveland, Ohio.

*TUNE IN "MUSICAL AMERICANA," N. B. C. RED NETWORK, COAST-TO-COAST, EVERY THURSDAY EVENING.*

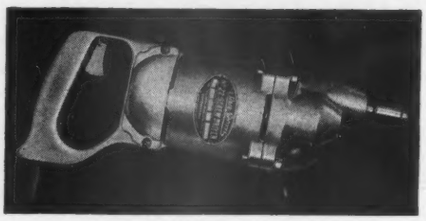
**Westinghouse Lighting Equipment**

## There's a Screw Driver or Nut Runner in the VAN DORN LINE *to Drive Anything*




When Van Dorn Portable Electric Screw-Drivers or Nut Runners go on the job assembly time and costs go down! Pick out your toughtest problem—in shape, size or tight-working spots—and you'll find out you can lick it with a Van Dorn Screw-Driver or Nut Runner. Whether your plant drives screws or tightens nuts and bolts in metal or wood—delicate instruments, fabricated steel, autos, trucks or Army tanks—one of the 21 Van Dorn Screw-Driver and Nut Runner models will put *more speed* on your production line. Phone your jobber for a demonstration—or wire: Van Dorn Electric Tools, 719 Joppa Road, Towson, Maryland.

**FEATURES**
*For Every Type Job*
POSITIVE CLUTCHES • ADJUSTABLE CLUTCHES • REVERSING SWITCHES • TRIGGER SWITCHES • RIGHT ANGLE DRIVES • PADDLE SWITCHES • CLOSE CORNER DRIVES



"Van Dorn"
(DIV. OF BLACK & DECKER MFG. CO.)
THE "RED HEADED" PORTABLE ELECTRIC TOOLS

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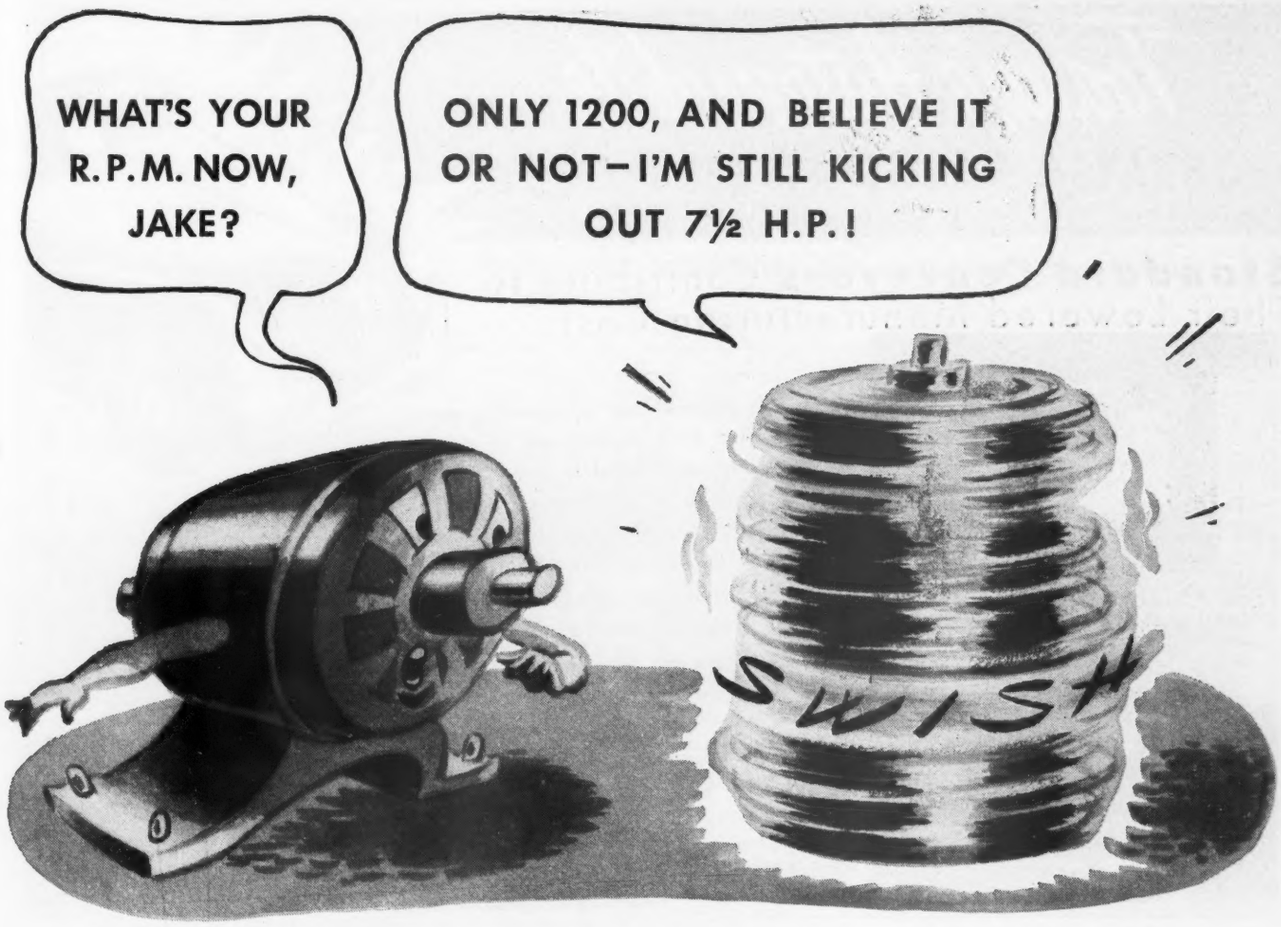


# Space factor of Fiberglas* Insulation permitted same H. P. at Fewer R. P. M.

A BROOKLYN, N. Y. manufacturer of fine furniture had three motors side-by-side, operating a 3-drum sander-machine. They were 7½ horsepower A. C. jobs, each turning over 1800 r.p.m.

The manufacturer wanted to reduce the r.p.m. of his motors, so that he could change from belted drive to direct drive. The obvious way to do this would be to put in a slower motor with a larger frame size.

But there were only ⅛ inch clearances between the motor frames!

So, as a test case, he decided to rewire *one* of these motors to run slower. Fiberglas Electrical Insulation was used because its *greater* space factor permitted the additional windings required. This slowed the motor down to 1200 r.p.m., but still allowed it to deliver its full rated horsepower.

That was 15 months ago and not one penny's worth of maintenance has been spent on the test motor, which operates as much as 20 hours a day.

No wonder the manufacturer has decided to rewire the other two sander-machine motors with Fiberglas!

### *What This Means To You*

There are two other variations on this small-motor trick of getting the same H. P. at lower r.p.m. You can get *more* horsepower out of your cotton insulated motors *without* increasing frame size by substituting Fiberglas Insulation, thereby allowing operation at higher temperatures. And you can get *more* horsepower *without* increasing weight.

Or you can get the *same* horsepower you have now by this method . . . in motors that are both smaller *and* lighter.

### *How To Go About It*

Write today for Fiberglas Electrical Engineering Data. Find out why insulation made from this glass in fibrous form has superior electrical insulating properties, how it withstands high temperatures, how it resists acids, oils, and chemicals, how its many other advantages can add up to important maintenance savings for you. Pick the toughest job you have. Put Fiberglas insulation in *that* spot . . . and see for yourself! Owens-Corning Fiberglas Corporation, Toledo, Ohio. In Canada: Fiberglas Canada, Ltd., Oshawa, Ontario.

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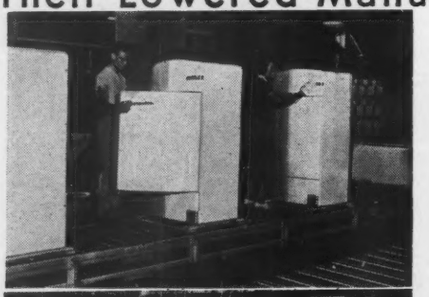
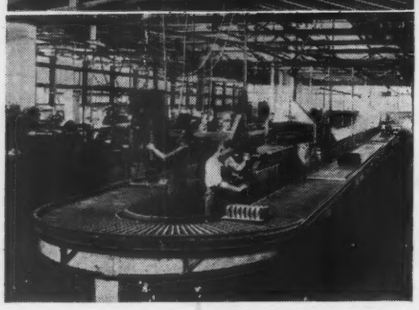
# SPECIFY FIBERGLAS ELECTRICAL INSULATION

# Today's Automobile

## GREATER VALUE AT LESS COST

## *Standard Conveyors* Contribute to Their Lowered Manufacturing Cost . . .





Today's automobiles, representing more value than ever before and at a cost averaging approximately only 25¢ per pound compared to an average of $2.00 per pound twenty years ago, are a striking example of efficient manufacturing methods in which conveyors play an important role.

The Standard Conveyor Company has often worked with many of the leaders in the great automotive industry.

To build greater value in your products, investigate what modern Standard Conveyors offer your company by way of better production at lower cost.

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**CONVEYORS**

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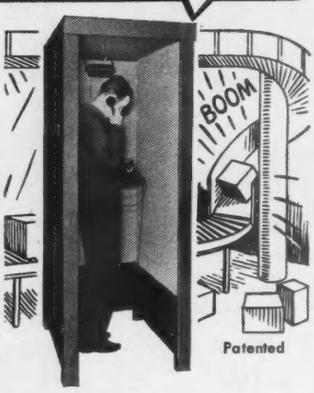
## I Hear You Distinctly in this Acousti-Booth




● It is so easy to hear, even in the noisiest shop, when your factory telephone is used in a Burgess Acousti-Booth. The acoustic lining soaks up noise and creates a remarkable "zone of quiet" within the booth. You can always hear distinctly no matter how close you are to noisy machinery.

Hundreds of these *doorless* booths are in daily use from coast to coast. We shall be glad to send you an illustrated catalog showing various Burgess models and names of satisfied users. Just mail the coupon.

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Firm Name_____

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**BURGESS ACOUSTI-BOOTH**
*Manufactured under Burgess Patents*

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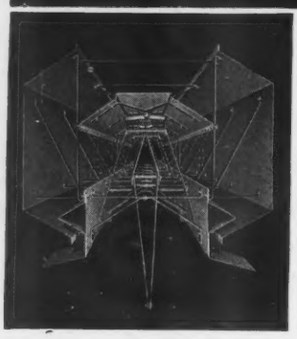
## BURT MONOVENT Continuous Ridge VENTILATOR



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**SYNCHRONOUS PROGRAM CLOCK**

For operating time signals or controlled time processes.
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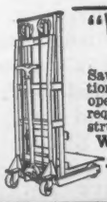

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Saves Production Time in many operations. Full Hydraulic Lifting Unit, hand-operated, finger tip control. Compact, requires little space. Arc-Welded Construction. ★*Write for Bulletins*
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PURE THREE POINT LUBRICATION
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Is your plant being penalized because you're holding up the flow of materials? The uninterrupted movement of supplies and finished products from receiving platforms to operating departments to stockrooms makes for greater success—and greater profits—in any business!
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The EWC LOAD-SKIDDER is a fine temporary storage skid — instantly convertible into a complete floor truck with the EWC DRAW-JACK.
One low cost DRAW-JACK will serve 5 to 20 skids, and you can stack empty skids against the wall out of the way. EWC LOAD-SKIDDERS operate in closer quarters than a floor truck, and are lighter to handle.
WRITE FOR BULLETIN, Prices, and helpful suggestions.
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Slip-Not makes greasy, oily, wet floors slip-proof at a cost of less than 1c per 50 square feet. Slip-Not is a powder, not a paint — easily applied (with Spreader 3318 shown above) and easily removed. See for yourself how Slip-Not will eliminate costly falls in your plant. Write today for liberal FREE TRIAL SUPPLY to Sugar Beet Products Company, 310 Waller Street, Saginaw, Michigan.

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•

A recent letter from an important plant executive tells how FACTORY is used in his plant:

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Read FACTORY Regularly For Profitable Ideas On How To Cut Costs and Increase Profits.

# THE DEFENSE PROGRAM REGARDING MACHINE TOOLS

The situation as it exists finds—there are not enough new machine tools to supply the ever increasing demands of those who have received national defense orders and the metal working industries in general. It is imperative that they receive immediate assistance.

Private industry can do its part to lighten the demand for new machine tools. How?—By releasing all idle and surplus machinery.

We and other used machinery dealers will buy up such equipment, and in turn sell to you such machines that we have available and which you are unable to get reasonable delivery on from the machine tool manufacturer.

UTILIZE WHAT IS AVAILABLE,
DON'T DEMAND
NEW MACHINE TOOLS ONLY!

We will do our part in co-operation with you.

Louis E. Emerman

*President,* Louis E. Emerman & Co.

**1763 ELSTON AVE.**
**CHICAGO**

# SEARCHLIGHT SECTION

## EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

**UNDISPLAYED RATE:**

15 cents a word, minimum charge $3.00.
*(See ¶ on Box Numbers)*

*Positions Wanted* (full or part-time salaried employment only), ½ the above rates.

*Proposals*, 50 cents a line an insertion.

**INFORMATION:**

*Box Numbers* in care of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.

*Discount of 10%* if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

**DISPLAYED—RATE PER INCH:**

The advertising rate is $8.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

*An Advertising inch* is measured ⅞ inch vertically on one column. 3 columns—30 inches—to a page. F.M.M.

*NEW ADVERTISEMENTS RECEIVED BY DECEMBER 18TH WILL APPEAR IN THE JANUARY ISSUE, SUBJECT TO LIMITATIONS OF SPACE AVAILABLE.*

*(See also preceding page)*


### SALARIED POSITIONS

**$2,500 to $25,000**

This thoroughly organized advertising service of 30 years' recognized standing and reputation carries on preliminary negotiations for positions of the caliber indicated above, through a procedure individualized to each client's personal requirements. Several weeks are required to negotiate and each individual must finance the moderate cost of his own campaign. Retaining fee protected by a refund provision as stipulated in our agreement. Identity is covered and, if employed, present position protected. If your salary has been $2,500 or more, send only name and address for details.

**R. W. BIXBY, INC.**
276 Delaware Bldg., Buffalo, N. Y.

### Key Men For Industry

We offer an ethical personnel service to INDUSTRY as well as above average men in management, engineering and manufacturing who wish to improve themselves.

**Curt E. Patton Personnel Eng'rs**
53 W. JACKSON CHICAGO

### METHODS IMPROVEMENT PROGRAMS

**CONSULTING AND TRAINING PROGRAMS FOR FOREMEN AND MOTION AND TIME STUDY MEN**

The upswing in industry has increased the demand for men trained to install effective operating methods. Management can have members of their own organization trained to do this work by using programs designed for this purpose. Industrial consultants conduct the programs and supplement the training with practical applications in the plant. Home study programs for individuals are also available. Information furnished upon request.

**METHODS ENGINEERING COUNCIL**
WOOD AND FRANKLIN STREETS
PITTSBURGH (21) PENNSYLVANIA

# SENIOR INDUSTRIAL ENGINEER WANTED

Established firm of Engineers intends to add a Senior Engineer to its industrial staff.

THE POSITION:—With a firm of Consulting Engineers that has been in business for many years; to take responsible charge of consulting jobs of an industrial nature; not a temporary position; some traveling necessary; base location in the East.

REQUIREMENTS:—Age 35-45; graduate of a recognized engineering college; manufacturing experience in the metal working industry; present minimum earning record of $6,000 per annum. Some consulting engineering experience desirable but not absolutely necessary. If these requirements cannot be filled please do not answer this advertisement.

PLEASE SEND:—Present address; date of birth; place of birth; marital status; college attended; degree and year obtained; chronological record of experience in detail showing dates, company name, position held, duties and salary; small photograph.

GENERAL:—All answers will be considered confidential: references and present employers will not be checked until agreeable to the applicant; interviews with selected applicants will be arranged at the Company's expense. Address reply to

P 761 Factory Management & Maintenance
330 West 42 St., New York City


## POSITIONS VACANT

INDUSTRIAL EMPLOYMENT, Plant Safety or job specification and evaluation experience. College graduate wanted who has had several years experience in industry and capable of acting as assistant to executive. Plant located in Ohio. Give age, education and experience. P-762, Factory Management & Maintenance, 520 N. Michigan Ave., Chicago, Ill.

TIME AND MOTION MAN, with special ability in method work. Mechanical ingenuity highly important. Write details as to age, salary expected, experience, etc. P-763, Factory Management & Maintenance, 330 W. 42nd St., New York, N. Y.

MECHANICAL ENGINEER, wanted by nationally known manufacturer. Technical and Practical Training. Experienced in design, development and shop work. Position permanent with chance for advancement for man capable of development of new products. Want man preferably under forty. Applications strictly confidential. Give full particulars, past record. P-764, Factory Management & Maintenance, 330 W. 42nd St., New York, N. Y.

## POSITIONS VACANT

CHIEF DRAFTSMAN: Permanent position available, should be technical college graduate. Experience should cover supervisory work of draftsmen; essential also is experience in plant layout, structural and design of chemical plant equipment. Reply stating age, education, marital status, details of experience and salary required. P-766, Factory Management & Maintenance, 330 W. 42nd St., New York, N. Y.

EMPLOYEE RELATIONS: opportunity for man with background of plant experience in industrial employment relations. Must be equipped with an understanding of basic policies that will qualify him to originate as well as administer industrial relations technics in sizeable manufacturing plant. Ability to promote ideas both verbally and in writing essential. Salary range depends on qualifications. Reply fully, giving samples, if talks or written material prepared personally. P-771, Factory Management & Maintenance, 330 W. 42nd St., New York, N. Y.

## EMPLOYMENT SERVICE

Executives and Technical Men. Qualified candidate desiring $2,500 to $20,000 positions may contact employers through our confidential services, established 25 years. The National Business Bourse, 20 W. Jackson Blvd., Chicago.

## POSITIONS WANTED

CHIEF INDUSTRIAL ENGINEER — Asst. Works Manager — Director of Training. Eighteen years experience time and motion study, methods improvement, cost reduction, budgets, standards, factory planning, job classification, supervision. Excellent labor relations. Qualified administer industrial engineering, cost reduction, training programs, to relieve executive of administrative details. Protestant. Employed. PW-757, Factory Management & Maintenance, 330 W. 42nd St., New York, N. Y.

ELIMINATE WASTE, Plan. Have things done. Industrial Engineer and Cost Accountant. Competent, honest, resourceful. Better worker than talker. Good experience and references. Age 38, single. PW-765, Factory Management & Maintenance, 520 N. Michigan Ave., Chicago, Ill.

**See Pages 189 and 191**
**Additional Positions Wanted, Selling and Business Opportunities, Property For Sale or Lease, and Used Equipment Advertising.**

THE KEYSTONE SERVICE OF ASSOCIATED REALTY BROKERS

**"NICRE" does not Sell or Lease Property. It offers, a central listing bureau for vacant property available.**

**Write for your free copy of the booklet entitled "How to take the 'Chase' out of PurChase."**

**Write for Complete Catalog.**

# FACTORY BUILDINGS & SITES offered BY BROKERS Through NICRE SERVICE

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| 1 | Michael Santori 780 E. 138 St. Bronx, N. Y. |
| 52 | Dwight, Voorhis & Hemlessey, Inc. 127 West 23 Street, New York City |
| 53 | Joseph P. Day, Inc. 405 Lexington Avenue, New York City |
| 55 | J. J. O'Connor, Organization 110 East 42nd Street, New York City |
| 63 | W. B. Moore, Irving Trust Co, 1 Wall St, New York City |
| 337 | C. Grant Keck Org. 27-10 Bridge Plaza, L. I. C, N. Y. |
| 342 | Paul Paulson of First Mortgage Securities Corp., 115 Penn Avenue, Brooklyn, N. Y. |
| ★ | Inquire: Nicre Service 401 Broadway, New York City |

**These Listings Represent but a few of the many Buildings and Sites now on file FOR SALE OR LEASE**
***Full descriptive circular on any property can be had by writing the Broker—See Brokers No. in index***

| STATE | TOWN | SQ. FT. | FLOORS | CONSTR. | SALE OR LEASE | REMARKS | PROP. NO. | BROKER NO. |
|---|---|---|---|---|---|---|---|---|
| NEW YORK | N.Y.C. | 69,000 | 3 | Steel Conc | Both | Modern | 123 | 52 |
| NEW YORK | Maspeth | 75,000 | RR siding | Vacant Land | Both | Will improve or divide | 130 | ★ |
| MICHIGAN | Lansing | 1,000,000 | 1 to 3 | Brick | Both | 3 bldgs. all or part | 144 | 53 |
| NEW YORK | Maspeth | 230,000 | RR Siding | Vacant Land | Both | Large Fdry. Bldg. included | 145 | 55 |
| NEW YORK | Brooklyn | 62,000 | 5 | Brick | Both | Sprinklered—Near Navy Yard | 155 | 342 |
| NEW YORK | N.Y.C. | 62,200 | 3 | Mill-Fireproof | Both | Sprinkler—2 bldgs. 1-40,000 sq. ft. | 162 | ★ |
| PENNA | Phila. | 125,502 | 3-5-10 | Fireproof | Both | 3 bldgs. 1-79,680 sq. ft. | 163 | ★ |
| NEW YORK | Bronx | 90,000 | 5 | Mill | Both | Will Divide | 169 | 1 |
| NEW YORK | L.I.C. | 42,500 | 2 | Brick | Both | Outstanding Bldg. | 177 | 337 |
| NEW YORK | Port Chester | 65,000 | Waterfront | Vacant Land | Both | City will co-operate | 180 | ★ |
| NEW YORK | Jamaica, L. I. | 120,000 | 2 plots | Vacant Land | Both | Both corner plots | 186 | 63 |

**NATIONAL INDUSTRIAL & COMMERCIAL REALTY EXCHANGE, INC.**
401 BROADWAY • *A Nationwide Industrial Property Realty Exchange* • NEW YORK CITY, N. Y.

# —TRANSFORMERS—

**A Complete Stock** **Prompt Shipment**

6—833 KVA Westinghouse Transformers, Type OISC, 60 cycle, 11000/10725/10450/10175/9900—2300/4000Y volts. Modern type.

**We Rewind, Repair and Redesign all Makes and Sizes**
**ALL TRANSFORMERS GUARANTEED FOR ONE YEAR**
**Write for Catalog No. 135-D**

**THE ELECTRIC SERVICE CO., INC.**
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI, OHIO

# ELECTRICAL MACHINERY

Motors and Generators, A.C. and D.C. for sale at Attractive Prices. Large stock. New and Rebuilt. All Guaranteed. *Write for Stock List and Prices.*

**V. M. NUSSBAUM & CO.**
**FORT WAYNE, IND.**

# manufacturing industries

frequently need competent men. They can be located quickly and economically through the Searchlight Section of FACTORY Management & Maintenance. Over 26,000 other subscribers actively engaged in the manufacturing industries see "Searchlight" every month.

# I Will Buy or Invest In a Business

**I will buy or invest in a business doing from $50,000 to $500,000 annually, provided its character is such that I can also invest my interest, enthusiasm and demonstrated knowledge of sales and promotional work.**

**I am an individual approaching middle age, of independent means, who seeks an absorbing interest as much as a sound, legitimate business. I may find my objective:**

**(1) In an established business requiring the stimulus of new ideas as well as financial backing;**
**(2) In a new industry past the experimental stage that needs aid to realize its possibilities.**

**The business should be capable of handling from a Boston headquarters.**

**BO-760 Factory Management & Maintenance**
**330 W. 42nd St., New York, N. Y.**

## POSITIONS WANTED

(Continued from opposite page)

MANUFACTURING EXECUTIVE: Practical mechanic with creative ability. Diversified experience, manufacture metal products raw materials to lacquered and plated finishes. Product design; costs; tooling-up; plant upkeep, and production. Wage systems, organization and labor relations. PW-767, Factory Management & Maintenance, 330 W. 42nd St., New York, N. Y.

DIRECTOR OF INDUSTRIAL RELATIONS: Ten years experience. Particularly excellent record in employee and supervisor training by conference method. Familiar with all phases of collective bargaining. Graduate engineer. Experienced in construction and chemical industries. Locate anywhere. Forty years old. Employed, but seeking wider opportunity. Available at once. PW-768, Factory Management & Maintenance, 520 N. Michigan

ENGINEER EXECUTIVE, experienced in product development, intricate mechanisms, precision manufacturing, sheet metal and stamping, resistance, arc and gas welding, mass production, organization and management, with thorough practical training and successful background. Seeks position where initiative, resourcefulness and inventive ability to solve unusual problems are required. PW-770, Factory Management & Maintenance, 330 W. 42nd St., New York, N. Y.

PLANT MANAGER or Superintendent, M.E. 16 years diversified experience in every phase of manufacturing light and heavy mechanical products. Inventor of new type aircraft, motor, automotive, electrical devices. Chr. Anywhere. PW-769, Factory Management & Maintenance, 330 W. 42nd St., New York, N. Y.

## WANTED

80 K.W. A.C. Rebuilt-guaranteed Diesel electric generating plant. Mail full particulars. Box 355, Suite 1800, Times Bldg., N. Y.

ANYTHING within reason that is wanted in the field served by Factory Management & Maintenance can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.

## SOUTH AMERICAN REPRESENTATION

One of the largest, long established, progressive electrical supply houses in Brazil wishes exclusive factory representation for:
**Portable Air-Conditioning Units—Time Clocks—Capacitors—Small Rectifiers for Battery Charging and Movie Projectors—Steel Conduit.**
Appointments only with manufacturers.
**RA-759, Factory Management & Maintenance**
330 West 42nd St., New York City

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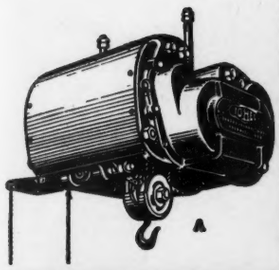
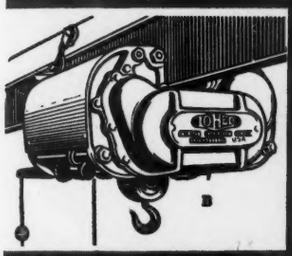
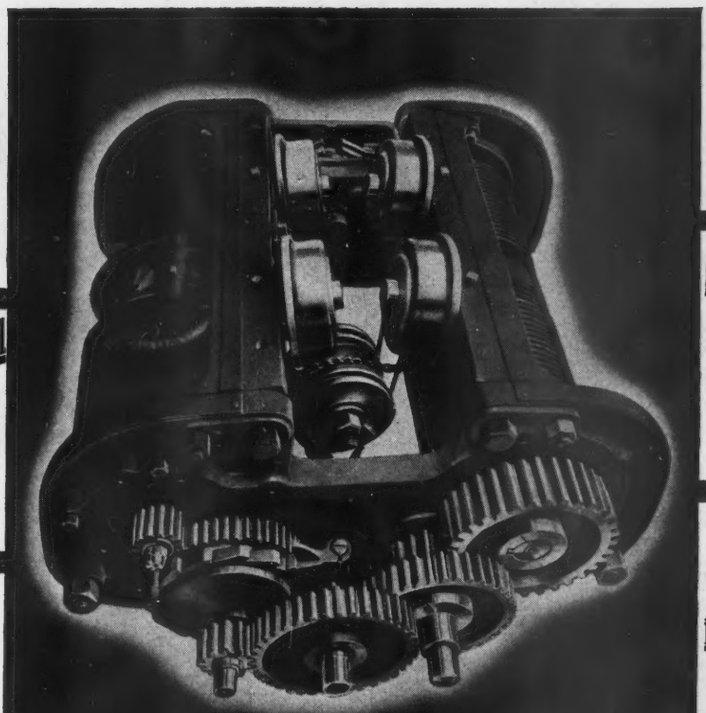


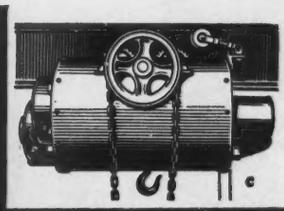



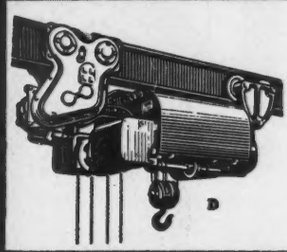

**THERE'S A LO-HED ELECTRIC HOIST FOR EVERY PURPOSE**

A—Bolt Suspension Type.
B—Plain Trolley Type.
C—Hand-Geared Type.
D—Motor Driven Trolley Type.
E—Cab-Controlled Type.

**CAPACITIES FROM ¼ to 12 TONS**





# WANT LOW HEADROOM?

## Get the ORIGINAL low headroom hoist

Low headroom is probably the greatest single advantage a hoist can have though, like the fourth gear on your car, you may not always use it. As long as you want it, and it costs no more to have, insist on low headroom. LO-HED is the all purpose hoist with the original low headroom feature.

Low headroom in a Lo-Hed is achieved by a unique type of construction in which the weight of motor and drum are neatly balanced on opposite sides of the rail, so that the hook can be pulled up between them. Take a look at this time-tested principle in the open-view of the Lo-Hed Hoist on this page. Then check carefully all these other time-tested features you gain when you buy a Lo-Hed: Heavy duty type hoist motor, automatic lowering brake, anti-friction bearings, stub tooth spur gears, plow-steel cable, 100% positive automatic upper limit stop, dust and moisture-proof controller. (Construction varies slightly for classes of Lo-Hed.)

Investigate Lo-Hed time-tested construction. Write today for the complete, fully illustrated Lo-Hed Catalog shown below.

**A-E-CO**
**LO-HED** *Time-tested* **HOISTS**

## AMERICAN ENGINEERING COMPANY

**2426 ARAMINGO AVENUE, PHILADELPHIA, PA.**

*OTHER A-E-CO PRODUCTS:* TAYLOR STOKERS, MARINE DECK AUXILIARIES, HELE-SHAW FLUID POWER

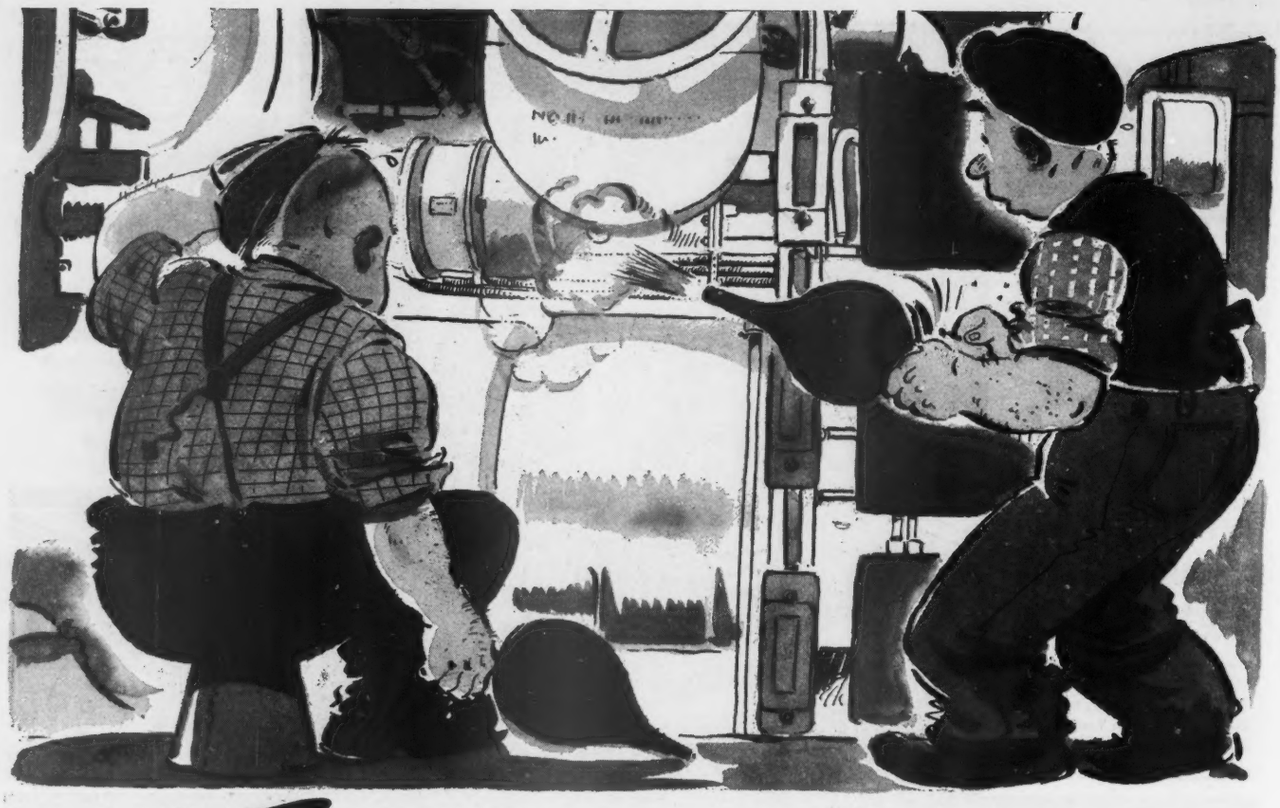
*Look in your classified telephone directory under "A-E-CO LO-HED HOISTS" for your nearest representative.*

**MAIL THIS COUPON NOW**

**AMERICAN ENGINEERING COMPANY**
**2426 Aramingo Avenue, Philadelphia**

☐ Please send me your 26 page complete catalog of Lo-Hed Hoists.
☐ Ask your representative to call.

Name_____
Company_____
Street Address_____
City_____ State_____
(Please print plainly)



# *Take a* HOT TIP

Sure, this is one way to prevent heat from pulverizing the insulation on wire running close to boilers, steam lines, lehrs, soaking pits, furnaces or other hot spots . . . but the boys *might* let up on the bellows and it doesn't seem practical anyway. Not when you can handle the situation with ROCKBESTOS permanently insulated wires that are built to take heat and just about everything else that will ruin ordinary wire.

When you install ROCKBESTOS asbestos insulated wires, cables or cords you are getting rid of the principal cause of wire failure . . . insulation breakdown . . . and you are making certain that your first cost will be your only cost. Better than that, in addition to saving the repeated expense of replacing short-lived wiring, you are eliminating wasteful current leakage, possibility of short circuit fires and assuring uninterrupted service which is even more important just now.

You'll find proof of our claims in every one of the 118 different wires and cables in the ROCKBESTOS line because they all have these service-guaranteeing features: They won't dry out because their insulation is heatproof . . . they won't burn or support flame because their insulation is fireproof . . . they won't rot, bloom or swell because their insulation is resistant to alkalies, grease, oil and corrosive fumes . . . and they were all designed to meet severe operating conditions in specific applications and have proven their ability to do so *effectively, economically* and *permanently*.

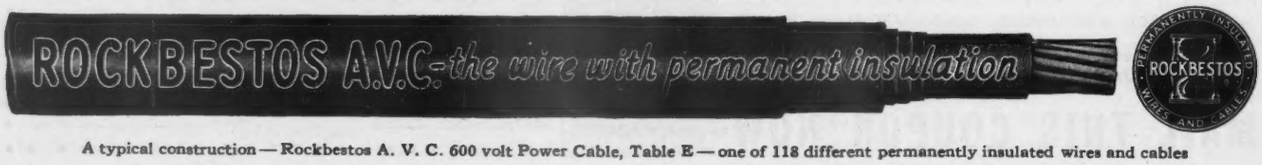
**TEN TESTED ROCKBESTOS VALUES**

1. HEATPROOF
2. FIREPROOF
3. PERMANENT
4. Lower maintenance cost
5. Resists heat and vibration
6. Saves work
7. Oil, Grease and Moisture resistant
8. High overload capacity
9. Permanently flexible
10. Greater carrying capacity

Our No. 10-E Catalog shows a complete line of money-saving permanently insulated wires, cables and cords. Send for it today. Rockbestos Products Corporation, 977 Nicoll St., New Haven, Connecticut.

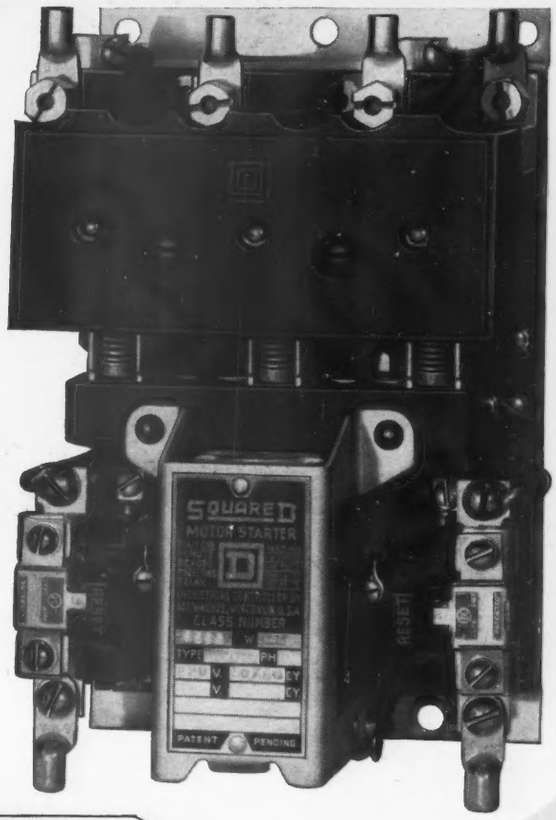
*Also refer to the Electrical Contracting and Electrical World Buyer's Reference Editions*

New York Buffalo Cleveland Detroit Chicago
Pittsburgh St. Louis Los Angeles San Francisco Portland, Ore. Seattle




A typical construction — Rockbestos A. V. C. 600 volt Power Cable, Table E — one of 118 different permanently insulated wires and cables

# A LINE OF STARTERS DESIGNED TO MEET TODAY'S REQUIREMENTS




**DEPENDABLE.** Electrically and mechanically these starters are built to withstand the severe service of high speed production methods.

**EASY TO WIRE.** Enclosing cabinets of all types and sizes provide ample wiring space. Sheet steel cabinets have knockouts at top, bottom, both sides and back. Cast metal enclosures have threaded conduit entrances at top and bottom. Terminals are accessible and clearly marked. Starter is wired in two colors for easy identification of control and power circuits. Thermal relays in plain view for checking current ratings.

**ACCESSIBLE.** All renewable parts can be inspected or replaced with minimum of time and labor. Contacts, springs and magnet coils are renewable without disturbing any line or load connections.

**VERTICAL OPERATION.** Straight line vertical action from magnet to contacts eliminates flexible leads, permits compact design and prevents accidental closing.

**DOUBLE BREAK CONTACTS** increase current rupturing capacity. Contacts are silver, non-corrosive and require no cleaning or dressing. Stationary contacts are interchangeable; movable contacts are removable without tools.

**ENCLOSED ARC CHAMBERS** confine such arcing as may occur. The higher rated contactors have magnetic yokes which act as blowouts—an exclusive Square D feature.

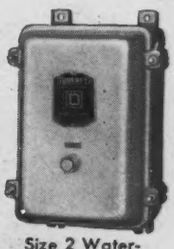
**MAGNET.** A modified "E" type construction gives exceptional pick-up and sealing characteristics even at low voltage. Two shading coils minimize magnetic hum.

***For complete information write for new bulletin No. 137.***

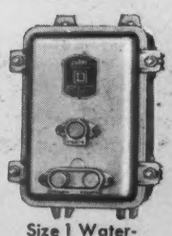
**STARTERS IN SIZES UP TO 50 H.P., 440-550 VOLTS**
**MECHANISMS INTERCHANGEABLE FOR ALL TYPES OF ENCLOSURES**

Size 2 General Purpose Enclosure

Size 2 Dust-Tight Enclosure


Size 2 Water-Tight Enclosure

Size 2, Class 1, Group D Enclosure


Size 1 Water-Tight Enclosure

Size 1, Class 1, Group D Enclosure

**CALL IN A SQUARE D MAN**

**SQUARE D COMPANY**

DETROIT - MILWAUKEE - LOS ANGELES

IN CANADA: SQUARE D COMPANY CANADA LIMITED, TORONTO, ONTARIO

# *Park your Drive Theories Outside*

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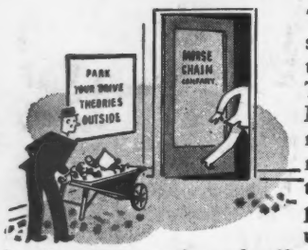
## AND LEARN ABOUT MORSE ENGINEERED HIGH SPEED DRIVES




TRADITIONAL chain speed limits have been tossed out the window. Tossed out because some Morse engineers decided not to accept the old rules, and went ahead to find out what happened with drives which used larger sprockets having more teeth, and mile-a-minute chain speeds.

The results amazed even the engineers, pointed out a whole new series of facts on which to plan efficient, economical chain drives.

Centrifugal force, said the old beliefs, ruined the practicability of chain drives operating at speeds above 3,000 feet per minute. This seemed logical because of experience with other forms of drive using pulleys where additional tension is required at speeds above 3,000 feet per minute to offset the loss of "grip" due to centrifugal force.

"Teeth Not Tension" changes the whole picture.

Research in laboratory and field, carried on by Morse engineers for several years using larger sprockets with chain speeds zooming up to almost 8,000 feet a minute, has resulted in some new concepts of chain drive engineering. As sprocket sizes are increased, thus stepping up chain speed, the ability of the chain to transmit power increases tremendously, and unbelievably silent operation results. Since centrifugal forces do not cause loss of traction because of driving over teeth, they need not be considered as additional forces to the working load when within working limits of stress. Working loads can be increased at high chain velocity because of the tapered nature of load application, and maximum drive efficiency is realized when chain velocity reaches the point where centrifugal load equals working load.

Since, in a well-designed high speed drive, joint wear and consequent pitch elongation are practically eliminated, drives may operate on fixed centers. Even distribution of driving forces over nearly all teeth in contact makes sprocket wear slight, practically disappearing when teeth are heat treated.

With practically noiseless operation and simple lubrication made possible by the new Morse "wave" principle, bearing loads reach a new low with absence of drive tension and greatly reduced drive width.

The largest field for these drives is where ratios are from 1:1 to 4:1, and rotative speeds from 400 to 4,000. These drives have efficiencies up to 99.4% and insure noiseless operation, long and trouble-free life, greatly reduced bearing loads, and minimum space requirements.

The Morse chains and sprockets are carried in complete stocks in many cities throughout the country. Get in touch with the Morse man, and learn how Morse service continues to improve.

SILENT CHAINS ROLLER CHAINS FLEXIBLE COUPLINGS KELPO CLUTCHES

# MORSE *positive* DRIVES

MORSE CHAIN COMPANY ITHACA N. Y. DIVISION BORG-WARNER CORP.